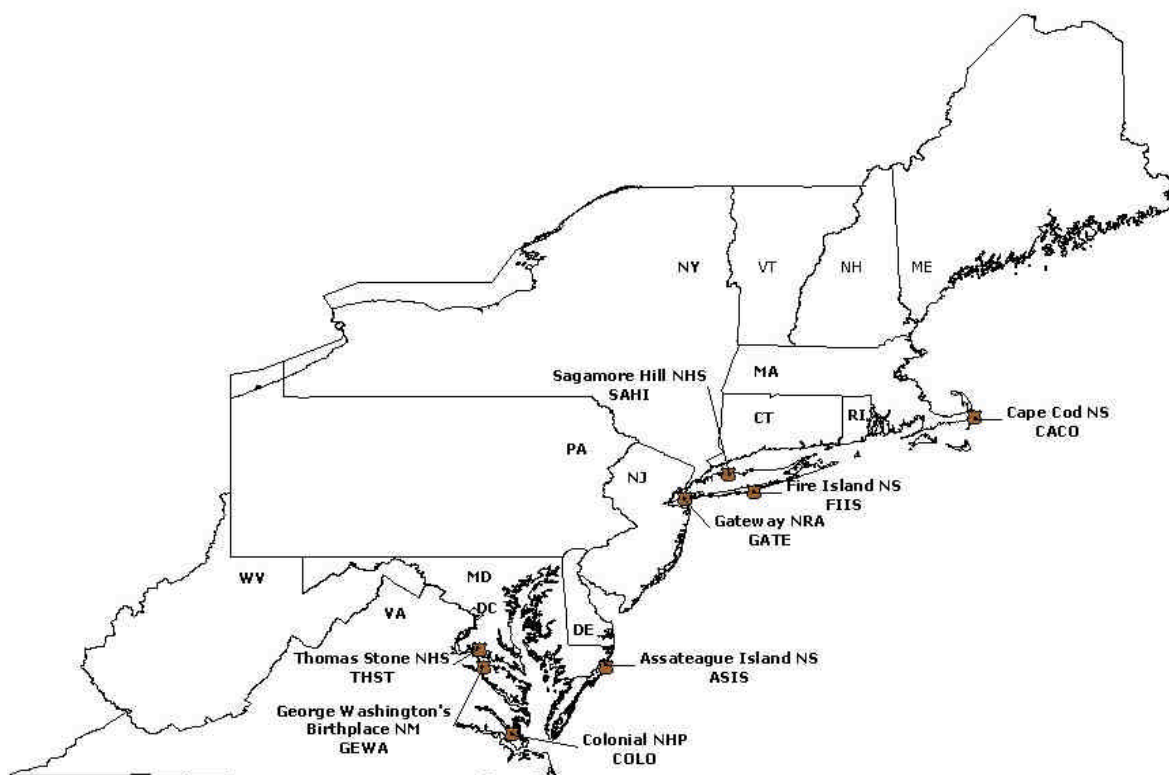


*National Park Service  
Inventory and Monitoring Program*

**Northeast Coastal and Barrier Network  
Inventory Study Plan For:  
Vertebrate and Vascular Plant Species**

**Fiscal year: 2002  
Funds Requested FY02: \$279,609  
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## Section I-Introduction

Habitat loss and fragmentation are two of the most significant threats to biological diversity today (Primack, 1993). As large tracts of public lands, such as national parks, become more insular from increased fragmentation due to agricultural development, urbanization, or other land use changes, these lands will become increasingly valuable for the long-term maintenance of floral and faunal diversity as well as the functional integrity of landscapes and ecosystems in the United States (Ambrose and Bratton 1990, Yahner et al. 1995). As one of the largest land managers in the United States, it is crucial that the National Park Service (NPS) first determines the extent and then maintains existing biological diversity within its parks.

Since the establishment of the National Park Service, natural resource data has been collected by various sources, university scientists, scientists within the parks, and organized groups such as state breeding bird atlases, state herpetological atlases and other similar watch groups. Although this biological information exists for many of the parks, much of it has never been compiled and reviewed by the Service. Over the past decade, the National Park Service has been working to establish what is now called the Inventory and Monitoring Program (I&M program). The principal and simplified functions of this program are to gather existing as well as new information about the natural resources in the parks and to make that information easily available at different levels, to park resource managers, the scientific community and the public. Another function of the I&M Program is to develop long-term techniques and strategies for monitoring the diverse expanse of ecological communities that make up the National Park System. A basic component of this program is the creation of databases that can store such an enormous amount of information and at the same time be user friendly and accessible. The National Park Service has created three such databases, NPSpecies to store information about the existing and historical records of species in each park, the NRBIB a bibliographic database to house all existing natural resource publications for each park, and the Dataset Catalog which references park spatial and electronic data sets.

For park managers to effectively try to maintain the biological diversity and ecological health of their parks, they must have a basic knowledge of what natural resources exist in parks as well as an understanding of those factors that may threaten them. One of the first goals of the I&M program will be to establish baseline biological inventories for vascular plant and vertebrate species in order to provide reliable species lists, a fundamental tool for management. The program will also begin to gather relative abundance and distribution information for species of special concern. Detailed information on exotic invasive plant species for example, as well as on rare and threatened species can enable more effective management practices. The simple knowledge of what and where species exist in the parks is crucial in making decisions on such things as building new trails, buildings and restoring cultural landscapes. Phase II of the I&M program will involve developing long-term monitoring programs to efficiently and effectively monitor ecosystem status and trends over time within the parks. Without the baseline information that will be gathered in Phase I, such long-term monitoring programs can not effectively be established.

In order to reduce costs and increase efficiency, the National Park Service has clustered parks into I&M Program “Networks” so that data acquisition might occur simultaneously at several locations. The basic data themes that have been identified for the Phase I natural resource inventory represent the recommended minimal data set for all natural resource parks. These data theme descriptions can be found in the Inventory and Monitoring Guidelines for Biological Inventories (National Park Service, 1999).

Priority biota groups include:

vascular plants

vertebrates

federally and state listed threatened and endangered species

species of special concern within the park, including endemic, nonnative, and other

species identified by legislation.

### 1.1 Goals and Objectives of the Northeast Coastal and Barrier Network

The Northeast Coastal and Barrier Network Inventory Study Plan is a detailed plan for completing inventories of vascular plant and vertebrate species within eight National Parks in the Northeast Region. These parks cover five states along the eastern seaboard, MA, NY, NJ, MD and VA. This plan reflects the goals and objectives of the Coastal and Barrier Network within the context of the National I&M Program goals and objectives listed below:

- To document through existing, verifiable data and targeted field surveys the occurrence of at least 90 percent of the species of vertebrates and vascular plants currently estimated to occur in each park.
- To describe the distribution and relative abundance of species of special concern, such as Threatened and Endangered species or exotic species occurring within park boundaries.
- To provide the baseline information the parks need to develop and implement a general monitoring strategy once inventories have been completed.

This document describes the plan of action that will be taken over the next four years to implement biological inventories in the Network parks. This plan has been developed after discussion with park resource managers, a scoping workshop held in Virginia that included Colonial National Historical Park (COLO), Thomas Stone National Historical Site (THST) and George Washington Birthplace National Monument (GEWA), and review of existing data and projects.

## Section II Park Descriptions

The Coastal and Barrier Network consists of eight parks ranging in size from 83 to 48,000 acres and are located across four coastal states (Table 1). All of the parks in this network cover a wide range of habitat types from the salt marshes and sandy beaches of

the Cape Cod National Seashore to the maritime holly forest of Fire Island National Seashore and barrier island habitats of Assateague Island National Seashore.

Table 1. Northeast Coastal and Barrier Network parks.

| Park   | State  | Est.    | Federal Acreage | NonFed. Acreage | Total Acres | HA     |
|--|--------|---------|-----------------|-----------------|-------------|--------|
| Assateague Island National Seashore (ASIS)   | MD,VA  | 1965    | 17,866          | 21,867          | 39,732      | 16,086 |
| Cape Cod National Seashore (CACO)            | MA     | 1961    | 27,501          | 16,104          | 43,604      | 17,653 |
| Gateway National Recreation Area (GATE)      | NY, NJ |         | 20,444          | 6,166           | 26,610      | 10,773 |
| Fire Island National Seashore (FIIS)         | NY     | 1981    | 6,241           | 13,338          | 19,580      | 7,927  |
| Colonial National Historical Park (COLO)     | VA     | 1930/36 | 9,274           | 75              | 9,350       | 3,785  |
| George Washington Birth Place NM (GEWA)      | VA     | 1930    | 550             | 000             | 550         | 223    |
| Thomas Stone National Historical Site (THST) | MD     | 1978    | 322             | 6               | 328         | 130    |
| Sagamore Hill National Historic Site (SAHI)  | NY     | 1962/66 | 83              | 000             | 83          | 34     |

### **Assateague Island National Seashore (ASIS)**

Berlin, MD and Chincoteague, VA

Visitation 1,891,992

ASIS encompasses more than 39,000 acres, more than half of which is comprised of oceanic and estuarine waters surrounding the Island. Located within a three-hour drive of the Washington/Baltimore/Philadelphia metropolitan area, the National Seashore hosted more than 1.8 million visitors in 1999. The natural resources showcased by the park include a diverse assemblage of aquatic and terrestrial wildlife (including the free-roaming feral horses for which Assateague is famous), vegetation communities, and geological features and physical processes reflecting the complexity of the land/sea interface along the Mid-Atlantic coast. The indigenous plant communities reflect the adaptive extremes necessary for survival on a barrier island, where exposure to salt spray, lack of freshwater, and shifting sands creates a harsh and dynamic environment. Throughout the Seashore, the relationship of land and water is paramount.

Changing patterns of land use in the watershed of the coastal lagoons of ASIS threatens park water quality and biotic systems. Although park waters are considered to be in “good” condition at present, nearby estuaries with more extensive development are significantly degraded, primarily due to eutrophication from anthropogenic nutrient inputs. With a projected growth rate of >20% over the next 25 years, the potential for similar degradation of park waters is considered high. The ability to document changing estuarine conditions, including trends in submerged aquatic vegetation, fish, and benthic invertebrate community composition, is considered crucial towards influencing and mitigating local/regional development.

Since 1935, the federal navigation channel at Ocean City, MD has disrupted the natural sediment supply to Assateague Island, resulting in wholesale physical and biological changes. A comprehensive mitigation program has been developed involving both short term (one-time beach nourishment) and long term components (sediment bypassing). Implementation and management of these programs will require the ability to

continuously evaluate island conditions, (including changes in the distribution and abundance of rare species), relevant physical processes, and the effects of restoration actions in order to optimize outcomes and ensure maximum compatibility with management objectives.

Portions of ASIS provide suitable habitat for a variety of state and federally listed species, both plants and animals. The known and perceived threats to these species vary in intensity, and include a range of causative factors including recreational activities, disruptions to natural coastal processes, and interactions with both native and non-native species. Certain high-profile species such as the piping plover are being actively managed, but others remain poorly understood and are largely ignored. In particular, rare resident plant and insect species, and transient bird species lack appropriate levels of documentation (presence/absence, distribution and abundance) threat mitigation, and assessment.

Non-native plant (especially *Phragmites* and asiatic sand sedge) and animal species (feral horses, sika deer, nutria) present on Assateague Island are known to be having a significant impact on several of the primary vegetation communities occurring within ASIS. Documented effects include reduced health and reproductive capacity of certain key plant species, changes in species abundance and community composition, and loss of faunal biodiversity. The development of long-term management programs to mitigate the impacts of these species requires a variety of basic life history, distribution, and relative abundance data to guide decision-making and program implementation/evaluation.

### **Cape Cod National Seashore (CACO)**

Wellfleet, MA

Visitation 4,915,414

Cape Cod National Seashore comprises 43,604 acres of shoreline and upland landscape features, including a forty-mile long stretch of pristine sandy beach, dozens of clear, deep, freshwater kettle ponds, and upland scenes that depict evidence of how people have used the land. A variety of historic structures are within the boundary of the Seashore, including lighthouses, a lifesaving station, and numerous Cape Cod style houses. The Seashore offers six swimming beaches, eleven self-guiding nature trails, and a variety of picnic areas and scenic overlooks.

### **Gateway National Recreation Area (GATE)**

Staten Island, NY

Visitation 6,813,607

Gateway is 26,645 acres of coastal uplands, freshwater ponds, marshes, bays and mudflats. Established in 1972, it is divided into three geographically separate units that constitute some of the largest and most significant natural areas remaining in the metropolitan New York City area. They include Sandy Hook Unit, the Staten Island Unit (Great Kills Park and Miller Field) and the Jamaica Bay/Breezy Point Unit (Riis Park, Fort Tilden, Breezy Point Tip, Floyd Bennett Field, Plumb Beach, north shore of Jamaica Bay and the Jamaica Bay Wildlife Refuge). A tremendous amount of biological

information has been produced at GATE through the efforts of park staff and cooperators. Critical issues facing GATE that biological inventory might contribute knowledge to include: 1. adjacent land uses that impact on aquatic systems( distribution and abundance data would establish a baseline for seagrass). 2. Landscape management at Fort Tilden (abundance data for grassland birds would support re-establishing native grasses), 3. aircraft collision with birds originating in GATE (distribution and abundance data for laughing gull. Cormorant and geese are needed), 4. neotropical migrants use of park habitats and 5. Distribution and abundance measures for park wildlife that has the potential to impact on piping plover (federally listed species) or human health (potential rabies vectors).

### **Fire Island National Seashore (FIIS)**

Patchogue, NY

Visitation 559,764

FIIS is 19,300 acres of which approximately. 11,000 acres are submerged in the Great South Bay or Atlantic Ocean. This figure does not include Smith Point county park located at the eastern end within the boundaries of the National Seashore. Terrestrial habitats include 10% forested and 40% wetlands, 25% open (beach, swale and fields) and 25% developed by NPS and 17 local communities on the island. Of the submerged portion, 80% is in Great South Bay and 20% is the Atlantic Ocean. The park also include the William Floyd Estate that is 65% forested, 25% wetlands, 5% open space and 5% developed around the estate house area. Annual visitation exceeds 1 million.

Unique resources include: Sunken Forest (Maritime Holly Forest), Federal Wilderness Area (1300 Acres),and eel grass beds north of the Federal Wilderness Area. Approx. 10 Federal or NYS endangered species breed or germinate in park. Critical management issues include: Endangered species breeding and germination, exotic species management, cultural landscape management, recreational use, resource harvest, deer population management, beach renourishment, in-holding issues, mosquito management and management of commercial interests.

### **Colonial National Historical Park (COLO)**

Yorktown, VA

Visitation 3,136,262

COLO is composed of Jamestown Island (1500 acres), Yorktown Battlefield (4300 acres), and the Colonial Parkway (3600 acres) which connects the two. Within this area, the park's habitats include 37 miles of shoreline (34 acres), 55 miles of streams (55 acres), 2482 acres of wetlands, 3061 acres of floodplain, 5540 acres of forest and 1106 acres of managed fields. In addition, the park contains 4225 acres of Chesapeake Bay Regulatory Areas (Resource Protection Areas and Resource Management Areas). It harbors 11 rare, threatened or endangered faunal species, and 6 floral species. It provides nesting habitat for both American bald eagles and great blue herons, and contains Dry Calcareous Forest, a rare community type identified by the VA Division of Natural Heritage.

Biological inventory, in COLO, would provide data to evaluate many critical management issues. For example, distribution and abundance of rare flora and/or fauna is needed to formulate cultural landscape management strategies, earthwork preservation, erosion control, visitor impact, recreational use, exotic species management and endangered species protection and water quality.

#### *T&E Species*

##### **Plants:**

*Liparis loeselii* (Loesel's twayblade)  
*Listera australis* (Southern twayblade)  
*Malaxis spicata* (Florida adder's-mouth)  
*Stewartia ovata* (mountain camellia)  
*Utricularia fibrosa* (fibrous bladderwort)  
*Mitreola petiolata* (lax hornpod)  
*Verbena scabra* (sandpaper vervain)  
(sensitive joint vetch)-recently rediscovered in park

##### **Animals:**

*Ardea herodias* (great blue heron)  
*Casmerodius albus* (great egret)  
*Haliaeetus leucophalus* (bald eagle)  
*Ixobrychus exilis* (least bittern)  
*Stygobromus araeus* (Tidewater interstitial amphipod)  
*Gammarus pseudolimnaeus* (Northern spring amphipod)

##### **The Park Includes:**

- 37 miles of shoreline (34 acres)
- 55 miles of streams (55 acres)
- 2482 acres of wetlands
- 3061 acres of floodplain
- 5540 acres of forest, including Dry Calcareous Forest, a rare community type identified by the VA Division of Natural Heritage
- 1106 acres of managed fields
- 4225 acres of Chesapeake Bay Regulatory Areas (Resource Protection Areas and Resource Management Areas)

##### **COLO Management Issues:**

- Cultural landscape management (The distribution and abundance of rare flora and/or fauna is needed to formulate management strategies for the cultural landscape)
- Earthwork preservation
- Erosion control
- Visitor impact and recreational use
- Exotic species management
- Endangered species protection
- Water quality



## **George Washington Birthplace National Monument (GEWA)**

Washington's Birthplace, VA

Visitation 127,449

George Washington's Birthplace National Monument (GEWA) is located on the Northern Neck of rural and tidal Virginia about 45 miles east of Fredericksburg on highway 3 and about 80 miles south of Washington, D.C. in Westmoreland Co.

The park is fairly flat, typical of the Coastal Plain, and is comprised of about 551 acres of lands bounded by the Potomac on the north, Pope's Creek estuary in the east and south and private land to the south and west. Salinity of Pope's Creek and other brackish water marshes within the park can be as much as 60% seawater. Habitats include about 280 acres of open grasslands, 220 acres of forests, 25 acres of marshes and estuaries, 18 acres of memorial cultural landscapes, 5 acres of beaches and dune habitats, and 3 acres of developed lands.

The majority of forests within GEWA range in age from 90 to 120 years in age. The oldest trees are Black Gums and approach 180 years in age (*Nyssa sylvatica*). Upland forested areas of the park are dominated by a unique assemblage of loblolly pine (*Pinus taeda*) and willow oak (*Quercus phellos*). Other species include sweetgum (*Liquidambar styraciflua*), copious American holly (*Ilex opaca*) and Eastern red cedar (*Juniperus virginiana*), American beech (*Fagus grandifolia*), oaks (*Quercus* sp., primarily white *Q. alba* and southern red *Q. rubra*), Virginia pine (*Pinus virginiana*), red maple (*Acer rubrum*), pawpaw (*Asimina triloba*) and an occasional tuliptree (*Liriodendron tulipifera*). The herb and layer is sparse due to canopy shading and deer over grazing.

As upland habitats loose elevation, fresh and saltwater marshes begin to dominate. Upstream, at the headwaters of the Bay tributaries, are fresh water marshes that are wooded (maple/ash, and few loblolly pine) and shrubby (bay species, swamp rose, marsh mallow, marsh hibiscus, sagitaria, grasses (wild rice), sedges, and rushes).

Freshwater marshes gradually come under the influence of tidal activity and the influx of brackish water. These tidal estuaries are important breeding and nursery grounds for fish and birds. Cattails, switchgrass and cordgrass, bulrush, marsh hibiscus, baccharis, wax myrtle, and marsh elder dominate this ecosystem. Much of this ecosystem is found at the mouths of streams and along the shores of Popes Creek. There are numerous islands that are found within Popes Creek with these dominant vegetation types.

By name, these marsh ecosystems are known as Dancing Marsh, Digwood and Longwood Swamps, and Bridges Creek. Birds, mammals, fish, reptiles and amphibians, and invertebrates abound in these ecosystems. Most of these ecosystems and species have never been fully described within the park. Phragmites is a concern in both fresh and brackish water marshes.

Management issues at GEWA include wildlife management, reintroduction of native warm-season and meadow species, shoreline stabilization, beach and bar management,

marsh management, forest management, exotic species, management for T&E species, complete inventories and conduct monitoring of all terrestrial and aquatic fauna and flora including invertebrate species, and GIS all habitats.

*The Park Includes:*

- 220 acres of mixed conifer/hardwood forest and loblolly plantations
- 280 acres of open grasslands
- 25 acres of marshes and estuaries
- 18 acres of memorial cultural landscapes
- 3 acres of developed lands
- 3 freshwater ponds
- 5 acres of Potomac beaches and dune habitats

**Management Issues:**

- Use of marshes by estuarine species
- Restoration of Pope's Creek as an estuary and spawning area for important species like oysters and sturgeon
- Saltwater and freshwater marsh health
- Delineating riparian habitats
- Restoration of forests, marshes, and fields
- Stabilization of erosive banks along the Potomac and the loss of vegetative species due to undermining of cliffs
- Exotic species management
- Restoring cultural landscapes
- Dune habitat characterization
- Critical search for T&E species
- Use or overuse of park resources by species such as deer and groundhogs
- Effects of pollutants from industry, municipalities, and farming practices on all fluvial and paludal environments
- Presenting better information to the public concerning the natural environment at GEWA
- Note: Most of Pope's Creek is in VA state jurisdiction, however, a proposal has been submitted to create a National Marine Estuary. GEWA could and should be involved in any restoration efforts.

**Thomas Stone National Historical Site (THST)**

Port Tobacco, VA

Visitation 4,038

Thomas Stone NHS is located in Charles County, Maryland approximately 25 miles due south of Washington, D.C. and 4 miles west of La Plata, MD. The park is bounded by private lands to the north and south, Rose Hill Road on the east, and Hog Hole Run on the west. There are 321.97 acres of federally owned property and 6.28 acres of privately owned land encompassed by the legislated boundary. The site is comprised of 130 ha of hilly lands that drain into the Hoghole Run, emptying into the Port Tobacco Creek about

1.75km south of the park boundary. Relief of the landscape is approximately 35 meters with three main drainages and numerous springs and seeps. About 100 ha are mixed forests, 20 ha fields and 2 ha of developed area. Structures on the park include the Thomas Stone Mansion and associated farm buildings constructed in the 18th-19th Centuries, the Stone family graveyard, and various 20th century support buildings.

The majority of park lands fall within the Hog Hole Run sub-basin, which is a tributary of the Port Tobacco River. Hog Hole Run, a perennial stream, lies adjacent to the western boundary of Thomas Stone NHS. The entire stream course along the park boundary is encompassed by an electric power line right-of-way for the Southern Maryland Electric Cooperative. Beaver colonies have been established along Hog Hole Run, which have resulted in wetland areas. Some of these wetlands extend onto park lands.

Two perennial, unnamed streams, can be found within the park. The primary sources of water for these streams are springs, seeps, and precipitation. The courses of both streams follow deep ravines; one on the east side of the park, and one adjacent to the Mansion House area. A man made pond, with an area of approximately 1/2 acre, is found near the park entrance. This pond is spring fed, with a small outlet to an intermittent creek.

A systematic inventory of the park's fauna and flora has not been conducted. Generally, vegetation within the park is typical of that found in the Mid-Atlantic portion of the Coastal Plain and throughout southern Maryland.

The majority of forests within THST range in age from 40 to 70 years in age. Most trees are fairly young and even aged, except for an occasional large beech or oak tree. Upland forested areas of the park are dominated by American beech (Fagus grandifolia), oaks (Quercus sp., primarily white Q. alba and southern red Q. rubra), and yellow poplar (Liriodendron tulipifera). The herb and shrub layer is sparse due to past livestock and current deer over grazing.

The upland/lowland transition zone includes sweetgum (Liquidambar styraciflua) and large specimens of American holly (Ilex opaca). The herb layer in this area includes ferns, Leiopodium, and Gordyera sp. Ironwood (Carpinus caroliniana) can be found in the lowland areas of the park. The herb layer includes ferns, nettles, japanese honeysuckle (Lonicera japonica), Corydalis flavula, sedges (Carex rosea and other species), chickweed (Stellaria sp.), and large-seeded forget-me-not (Myosotis macrosperma). Additional tree species found throughout the park include: Virginia pine (Pinus virginiana), hickory (Carya spp.), red maple (Acer rubrum), pawpaw (Asimina triloba) and blackgum (Nyssa sylvatica).

A park volunteer has recorded 109 avian species at THST. Species found at the park are typical of the mid-Atlantic region of the Coastal Plain. Casual observances of species which utilize the park indicate populations of mammals common to the mid-Atlantic states. Species found in the park include: raccoon (Procyon lotor), red fox (Vulpes vulpes), Eastern cottontail rabbit (Sylvilagus floridanus), Virginia opossum (Didelphis virginiana), and a large population of white-tailed deer (Odocoileus virginiana).

An active beaver (Castor canadensis) colony is located adjacent to the park boundary and within Hoghole Run. This colony makes use of trees located within the park along the margins of the stream.

Biological information would contribute to critical management issues such as: assessing the relative health of riparian and forest ecosystems; planning mitigation for the restoration of fields into native grasslands; planning restoration of forests; determining the presence of T&E and exotic species; determining wildlife use, such as beaver and fish in Hoghole Run; determining effects of hunting and power line rights of way on species, and providing for increased interpretive opportunities for the natural environment around the site.

#### **The Park Includes:**

- approximately 180 acres of forests
- 110 acres of maintained open fields
- 5 acres of riparian habitat
- 2 acres of maintained lawns.

#### **Management Issues:**

- rehabilitating a cultural landscape reclaiming all open acreage to native warm-season grass and meadow species
- mapping all vegetation
- conducting thorough faunal and floral inventories – including invertebrates
- monitoring deer browse activity
- monitor and manage for forest health and diversity
- eradicating invasive non-native vegetation

#### **Sagamore Hill National Historic Site (SAHI)**

Oyster Bay, NY

Visitation 67,193

Sagamore Hill NHS is the home of Theodore Roosevelt located on the peninsula of Cove Neck, Long Island, New York. In 1883 Roosevelt purchased 155 acres of farmland with shoreline on both Oyster Bay and Cold Spring Harbor. He quickly sold off 50 acres facing Oyster Bay to relatives, and built a large country home on the top of a hill with views across the water. Farm fields gave way to an oak-chestnut-tulip forest running down to a saltmarsh that opens to Cold Spring Harbor. His family eventually sold off more acreage until it reached its current size of 87 acres.

Today the farm has given way to visitor facilities including a parking lot and visitor center (2 acres combined), paved driveways, and mowed lawns (10 acres). There remains about 12 acres of rough fields. The forest of about 50 acres has matured despite the loss of the chestnuts to the blight. The easternmost forested and saltmarsh area of the

park was declared a "Natural Environmental Study Area" by Congress in the early 1970's. The 10 acre Eel Creek saltmarsh is an excellent example of the tidal saltmarshes that once lined the shore of Long Island.

Habitat types:

- 80% forested: oak-tulip-hickory

- 10% fields

- 8% saltmarsh

- 2% developed: parking lots, structures

There has been very little inventory work done at Sagamore Hill. The saltmarsh has had very little attention. We have some incomplete species lists (including TR's observations), but the only real survey was a herbaceous plant survey conducted by Dr. Richard Stalter of St. John's University in the early 1990's.

## **Section III Project Description**

### ***3.1 Existing Information***

#### *NPSpecies*

In the fall of 1999, resource managers in all eight of the Coastal and Barrier Network parks were asked to gather as many documents and electronic data sets as they could containing information on vertebrate and vascular plant species collected in their parks. These documents and electronic files were sent to the Natural Resource Information Division of the Inventory and Monitoring Program in Colorado in the fall of 1999 for data entry or electronic conversion to NPSpecies. NPSpecies an MS Access database, was developed by WASO to house all species data and related documentation for I&M parks.

After the initial population and release of the database back to the region, two part-time Research Associates (RA's) were hired (FY00) to work on NPSpecies for the Northeast. These positions were part of cooperative agreements with the University of Rhode Island (URI) and Penn State University (PSU). The research associates were and still are shared positions between four Networks, the Eastern Rivers and Mountains, the Mid-Atlantic, and the Northeast Temperate Networks. NPSpecies databases for the Eastern Rivers and Mountains and Mid-Atlantic Networks, as well as four Coastal and Barrier Network parks (ASIS, COLO, THST and GEWA), were maintained by the RA hired through Penn State. The databases for the Northeast Temperate Network as well as, CACO, GATE, FIIS and SAHI the other four Coastal and Barrier Network parks, were maintained by the University of Rhode Island RA. Recently it has been decided by regional staff to transfer the ASIS, COLO, THST and GEWA databases to the research associate working at URI, so that data for the entire Coastal and Barrier Network can be handled and housed in one location.

Once NPSpecies was released back to the Region, the RA's spent most of their time working with park personnel revising and updating records in the database. Parks were contacted and either a park data or resource manager was assigned to review and update the existing data for that park. The parks were asked to identify documents or existing database files that had been missed in the first call for data, and to send them to the appropriate RA (PSU or URI) for conversion or entry. Regional I&M staff also reviewed existing park NRBib citations and identified those that might contain pertinent species information that should be entered into the database. Parks were asked to provide copies of those documents if they thought they contained relevant species lists. Digital files submitted to WASO for initial entry into NPSpecies were also reviewed by I&M staff and additional data from these files was converted to the database.

Personnel in many of the Coastal and Barrier parks worked on NPSpecies to help clean it up and add additional data before it was sent back to WASO to be converted and uploaded to the web version. Ernie Taylor a wildlife biologist at FIIS for example spent a couple of weeks entering references and records that had been overlooked in the initial data sent to WASO. Bob Cook at CACO reviewed the CACO database and worked with Allison Hamel-LeBlanc, the URI RA, in getting excel files containing data on vertebrate and vascular plant species into their database before it was sent for upload to the web. Staff at SAHI reviewed and searched references listed in the park's NRBIB for appropriate data. ASIS and COLO reviewed and edited records in their databases before they were sent back to WASO.

### *NRBIB Database*

In 1996-1997 parks in the Coastal and Barrier Network were visited to gather existing bibliographic information to create the Network NRBIB database. Since then, little or no updating of this database has taken place. In November 2000, the Northeast Region's scientific librarian hired under cooperative agreement with Penn State University, began the process of updating the Network's database with the first park visit to ASIS. Scott Tiffney spent November to March updating ASIS' NRBIB by interviewing staff, searching staff bookshelves and filing cabinets and locating additional sources of information. This visit resulted in the addition of 963 new records giving a total of 1861 ASIS NRBIB records. Scott will be visiting the rest of the Coastal and Barrier Network parks throughout November 2001. Part of the database update will include searching local and state government resources and repositories such as Natural Resource Commissions, Utility Commissions and Land Management Offices, public, college, university, and state libraries as well as private and public agencies and CD-ROM, online and Internet resources. Because the park databases had not been regularly updated since 1997, they will require some initial editing and revision, specifically checking for duplicate records, missing bibliographic information, and/or incorrect bibliographic information before new records can be added. Existing records are being updated if necessary with new storage locations when applicable and/or more detailed bibliographic information if needed.

### *Dataset Catalog*

A cooperative agreement (FY00) was established with North Carolina State University (NC State) to complete FDGC metadata for all existing spatial data sets for four parks in the Coastal and Barrier Network, COLO, GEWA, THST and ASIS and the Mid-Atlantic and Eastern Rivers and Mountains Networks. NC State has been data mining for other spatial data sets existing outside of the parks and writing metadata for those as well. NC State staff are currently in the process of transferring the FDGC metadata they have created for the Park Service to the revised version of the Dataset Catalog released, May, 2001, this will be completed by October, 2001.

Under cooperative agreement with the GIS Field Technical Support Center at the University of RI, FDGC metadata is being completed on spatial data sets for CACO, GATE, FIIS and SAHI. This data will be converted to the new version of the Dataset Catalog in the near future.

### *Voucher Specimen Data Mining*

#### *Vertebrate and Vascular Plant Voucher Search-ASIS, COLO, GEWA, THST*

In order to provide verifiable and legal documentation of a species occurrence within Network parks, a cooperative agreement was established with Penn State University, to search institutions for voucher specimen information. One hundred and eight natural history museums and other institutions were searched in 1999-2000 for specimens collected within park boundaries. COLO, ASIS, GEWA and THST were part of this cooperative agreement that also included the Eastern Rivers and Mountains and Mid-Atlantic Networks (Table 2). All Investigator's Annual Reports (IAR) and collection permit contact information were reviewed in order to identify potential collections containing NPS specimens. An initial contact letter was mailed out to the identified sources requesting catalog number and specific locality information on specimens that were collected in these Network parks. Institutions were given a preliminary deadline of one month to receive records, however, since this deadline was rarely met, a second letter verifying receipt of the initial letter and offering further assistance was mailed out at that time. Additional contacts were made for delinquent institutions on a monthly basis until a response was received. Most larger institutions (e.g. Carnegie Museum of Natural History) requested monetary compensation for querying their databases. The decision to provide monetary compensation was made based on the likelihood of the institution providing a sizable amount of relevant data for the Network.

Records that were received from most, if not all institutions were not specific to a given park. In order to verify whether or not a specimen was collected from within a park, the data was sorted by park based on state counties. This information was then mailed to each park resource manager for further verification. As with the initial institutional contact letters each park was requested to return the verified records within one month upon receipt and re-contacted if the data was not returned.

Table 2. Institutions where voucher specimens were located for three of the parks in the Coastal and Barrier Network. No voucher records were found for THST at any of the institutions searched.

|  |
|--|
| <p><b>ASIS</b></p> <ul style="list-style-type: none"> <li>▪ Randolph-Macon College Insects (RMC)</li> <li>▪ North Carolina Museum of Natural Sciences (NCMNS)</li> <li>▪ Catalogue of Reptiles in the American Museum of Natural History (AMNH)</li> <li>▪ American Museum of Natural History (AMNH)</li> <li>▪ Delaware Museum of Natural History Bird Specimen Records (DMNH)</li> <li>▪ Cornell University Fish Records (CU)</li> <li>▪ University of Florida Herps (UF)</li> <li>▪ University of Michigan Birds (UM)</li> <li>▪ Shippensburg University Vertebrate Museum (SUVMM)</li> </ul> <p><b>COLO</b></p> <ul style="list-style-type: none"> <li>▪ University of Florida Museum of Natural History (UFMNH)</li> <li>▪ Cornell University Fish Records (CU)</li> <li>▪ Catalogue of Reptiles in the American Museum of Natural History (AMNH)</li> <li>▪ Catalogue of Amphibians in the American Museum of Natural History (AMNH)</li> <li>▪ Morris Arboretum of the University of Pennsylvania (UPMA)</li> <li>▪ University of Michigan Herp Records (UM)</li> <li>▪ Harvard University Herbaria (HUH)</li> <li>▪ University of Illinois Museum of Natural History (UIMNH)</li> </ul> <p><b>GEWA</b></p> <ul style="list-style-type: none"> <li>▪ George Mason University (GMU) collected by Gary Lam</li> </ul> |
|--|

*Vertebrate and Vascular Plant Voucher Search-CACO, SAHI, FIIS, GATE, ASIS*  
 Approximately 300 institutions have been contacted for information on voucher specimens collected in the four other Coastal and Barrier Network parks, CACO, SAHI, FIIS and GATE via an interagency agreement with Dr. Allan O'Connell of USGS-Patuxent. So far, close to 200 responses have been received. Although ASIS was searched through the Penn State University cooperative agreement, those institutions that were not searched at that time, were searched by the Patuxent staff for any specimens collected at ASIS. This project will be completed by January 2002 and all located data entered into NPSpecies. The following table lists those institutions that responded saying that they had data that was collected in the five parks.



Table 3. Institutions that have identified voucher data associated with the counties that include CACO, SAHI, FIIS, ASIS and GATE.

|  |  |
|--|--|
| Baylor-verts                             | New York State-mammals                 |
| Buffalo Museum Science-verts             | North Carolina Botanical Garden-plants |
| California Academy of Science-herps      | Planting Fields-plants                 |
| Carnegie Museum-plants                   | Royal Ontario Museum-Birds             |
| Carnegie Museum-Herps                    | Santa Barbara-birds                    |
| Carnegie Museum-mammals                  | Smithsonian-mammals                    |
| Chicago Academy Sciences-herps           | Swarthmore-birds                       |
| College of the Atlantic-vertebrates      | TAMU-herps                             |
| College of the Atlantic-plants           | Unity College-vert                     |
| William and Mary-plants                  | UCalBerkeley-Birds                     |
| Cornell Sounds-birds                     | UCal-Berkeley-Herps                    |
| Cornell University-birds                 | UCalBerkeley-mammals                   |
| Cornell University-herps.                | UConn-birds                            |
| Cornell University-mammals               | Ukansas-Herps                          |
| Deleware Museum of Natural History-birds | Ukansas-mammals                        |
| Denver Museum Natural History-birds      | Umass-plants                           |
| Field Museum-herps                       | UMichigan-Birds                        |
| Field Museum-Mammals                     | UMichigan-Herps                        |
| Field Museum-Birds                       | Umichigan-mammals                      |
| Florida Museum of Natural History-herps  | University of Minnesota-plants         |
| Florida Museum-birds                     | UNebraska-birds                        |
| Fort Hays State-birds                    | UNebraska-herps                        |
| Harvard University-mammals               | UNebraska-mammals                      |
| Illinois Natural History-Herps           | Museum Southwestern Biology-mammals    |
| Louisiana State University-herps         | UTEP-herps                             |
| Maine Natural Areas-plants               | U Washington Burke-Birds               |
| Mary Washington College-plants           | Utah Museum-Birds/Herps                |
| Michigan State-birds                     | Utah State University-plants           |
| Milwaukee Public Museum-herps            | Western Foundation-birds               |
| Museum of Science-herps                  | Yale-herps                             |
| Texas Tech-mammals                       | Yale-mammals                           |
| Nat Museum Los Angeles-Herps             | New York Botanical Garden-plants       |
| Nat Museum Los Angeles-birds             | New York Natural Heritage-plants       |

### *Fish Voucher Search*

Finally, a cooperative agreement was established with Dr. Jay Stauffer at Penn State University in FY00, to search institutions for freshwater fish specimens collected in and around parks part of the Northeast Temperate, Eastern Rivers and Mountains, Mid-Atlantic and Coastal and Barrier Networks. Efforts have been made to identify all the sources of fish distribution data for parks. Information on permitting of scientific collections within the parks was obtained. If fish collections were known to have occurred within the park the collector(s) were contacted and the fish data obtained. Collections made near each park can also provide important information about fish distributed within, and for this reason each state's fish management agency was contacted to determine other fish data sources. Lists of all entities known to have conducted fish surveys within each state were created. Availability of the data was assessed, and all available data reviewed for relevancy to park fish distributions. The data was then

obtained and incorporated into a northeast NPS parks' fish database, with all data being referenced to its original source.

### ***3.2 Inventory Needs Assessment***

Like many other I&M Networks, the Coastal and Barrier Network differs widely between parks in terms of the quality and quantity of inventory information available for them. There is also a wide range of variability in how existing data has been handled or managed in the parks. Some of the parks have maintained excellent species databases over the years while others have simply maintained libraries containing past work. One of the motives behind developing NPSpecies was to assist parks in handling both existing and new inventory data in a uniform fashion and to help lessen variability across Network parks in the management of their data.

For purposes of designing a Network inventory plan, NPSpecies was also to be used to help parks identify data gaps by determining what percentage of species within a taxonomic group (vertebrates and vascular plants) have been documented in a park so far. In other words, how close is each park to reaching the I&M program goal of documenting 90% of all vertebrate and vascular plant species existing in the parks? Comparing lists of documented species generated from NPSpecies, to expected species lists developed by experts could provide this information. While reviewing the database for the Network, it became apparent that a great deal of data has yet to be entered that would add a significant number of species to existing park lists. Also, many of the existing records have no "park status" associated with them to be able to accurately determine if a species has been documented as "probably present" or "present" in a park. Using the database to make an accurate assessment of inventory needs is not possible in its current state. Because of this, the Coastal and Barrier Network has taken a park-by-park approach to identifying inventory gaps at this time, and many of the projects in this plan involve the review of NPSpecies by taxa experts to determine further inventory need.

To begin assessing park vertebrate and vascular plant inventory needs, park staff were asked to review their existing inventory data and develop an inventory "needs" list. For some parks specific gaps were easily identifiable due to the expertise and extensive knowledge and familiarity of previous inventory work by park staff. For others, so little data on vertebrates and vascular plants had been collected in their parks, that projects were easily defined. Table 4 lists the inventory projects identified by park staff (further justification and description can be found in the Network pre-proposal, Appendix A).

Table 4. Inventory projects identified by Coastal and Barrier Network park staff.

| <b>Park</b> | <b>Project</b>   |
|-------------|--|
| <b>ASIS</b> | ▪ Data mining and compilation of existing bird data.                                 |
|             | ▪ Terrestrial Breeding bird survey   |
|             | ▪ Terrestrial mammal survey (including bats) distribution and abundance              |
|             | ▪ Assess existing marine mammal data for adequacy                                    |
|             | ▪ Freshwater aquatic plant survey  |
|             | ▪ Review of herp data by subject matter experts                                      |
| <b>CACO</b> | ▪ Breeding birds in terrestrial habitats inventory                                   |
|             | ▪ Update Rare plant survey   |
| <b>GATE</b> | ▪ Submerged aquatic plant Inventory  |
|             | ▪ Rare plant surveys-distribution and abundance information                          |
|             | ▪ Review existing bird data- identify gaps/determine % complete                      |
|             | ▪ Mammal Inventory (first review existing data)                                      |
|             | ▪ Review existing fish data-identify gaps/determine % complete                       |
|             | ▪ Marine invertebrate survey   |
| <b>FIIS</b> | ▪ Data mining and compilation of existing fish data and identification of data gaps. |
|             | ▪ Vascular plant inventory   |
|             | ▪ Aquatic plant inventory  |
| <b>COLO</b> | ▪ Plant Inventory (most data is from 70's and 80's on specific areas of park)        |
|             | ▪ Mammal Inventory   |
|             | ▪ Bird Inventory   |
|             | ▪ Herp Inventory   |
| <b>SAHI</b> | ▪ Bird Inventory (T. Roosevelt Park-Possible to begin MAPS Project at SAHI?)         |
|             | ▪ Mammal Inventory   |
|             | ▪ Fish Inventory   |
| <b>GEWA</b> | ▪ Bird Inventory (Last data from the 80's)   |
|             | ▪ Herp Inventory   |
|             | ▪ Fish Inventory   |
|             | ▪ Mammal Inventory   |
| <b>THST</b> | ▪ Bird Inventory   |
|             | ▪ Herp Inventory   |
|             | ▪ Mammal Inventory   |
|             | ▪ Fish Inventory   |

### *Assessing inventory needs for CACO, FIIS, GATE, ASIS*

#### **Assateague Island National Seashore**

##### *Vascular Plants*

Overview of Status. A basic inventory of terrestrial vascular plants occurring within ASIS is considered to be greater than 90% complete. Species presence is documented by three published reports, one unpublished report, and voucher specimens housed in the park's museum collection (Table 1). The voucher collection is fully documented in ANCS+ and is currently being entered into the NPSpecies database. Terrestrial vegetation communities/alliances were described and mapped in 1986 (Hill) and 1998 (Nature Conservancy & ESRI). Maps are scheduled for revision and updating in 2002-

2003. Known marine vascular plants (two species) are documented by voucher specimens in the park's museum collection. Distribution and relative abundance of marine vascular plants is mapped annually as part of a cooperative monitoring program.

Outstanding Needs. While the overall inventory of vascular plants is considered relatively complete, periodic surveys of targeted habitats are needed to evaluate the status of rare and/or ephemeral species. Of particular interest are early successional, disturbance-driven beach habitats. Additional surveys of freshwater habitats for obligate aquatic species may also be warranted as previous floristic surveys are thought to have inadequately sampled those areas. *Recommended action:* Conduct opportunistic surveys of freshwater habitats (park staff) to identify freshwater vascular species.

Table 5. Vascular Plant Inventory Data for ASIS

| Data Type          | Citation and/or Description   |
|--------------------|---|
| Published Report   | Hill, Steven R. 1986. An Annotated Checklist of the Vascular Flora of Assateague Island (Maryland and Virginia). <i>Castanea</i> 51: 265-305                                      |
| Published Report   | Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The Flora and Ecology of Assateague Island. University of Maryland Agricultural Experiment Station Bulletin A-172.          |
| Published Report   | Stalter, Richard, and E.E. Lamont. 1990. The vascular Flora of Assateague Island, Virginia. <i>Torreyia</i> 117 (1): 48-56  |
| Unpublished Report | Lea, Christopher, H. Hamilton, F.K. Hudson, and N. Roeder. 2000. Additions to Flora and Rare Plant Surveys and Status, 1996-1999. Assateague Island National Seashore. Berlin, MD |
| Voucher Specimens  | ASIS herbarium collection including materials collected by S.R. Hill, E.A. Higgins, and park staff  |

### *Reptiles and Amphibians*

Overview of Status. A basic inventory of reptiles and amphibians occurring within ASIS is considered to be relatively complete (*probably* > 90%). Species presence is documented by three published reports, one unpublished report, voucher specimens housed in the park's museum collection, and unpublished data (Table 2). The voucher collection (incomplete) is documented in ANCS+. Information describing the distribution and abundance of reptile and amphibian species is, however, very minimal.

Outstanding Needs. Mitchell et al (1993) recommended that additional inventory efforts for reptiles and amphibians occurring within ASIS were warranted, and that future efforts should focus on specific taxonomic groups and habitats, including frogs, freshwater turtles, and snakes. The relative merit of short-term intensive surveys versus long term monitoring in documenting additional species at ASIS is unclear, and should be evaluated by subject matter experts. *Recommended action:* Convene meeting of local/regional subject matter experts to review status and recommend course of action to complete basic inventory.

Table 6. Reptile and Amphibian Inventory Data for ASIS

| <b>Data Type</b>   | <b>Citation and/or Description</b>   |
|--------------------|--|
| Published Report   | Lee, David S. 1972. List of Amphibians and Reptiles of Assateague Island. Bulletin Maryland Herpetological Society, Vol. 8, No. 4, pp. 90-95.  |
| Published Report   | Conant, Roger, J.C. Mitchell, and C.A. Pague. 1990. Herptofauna of the Virginia Barrier Islands. Virginia Journal of Science, Vol. 41, No. 4A, pp. 364-380.  |
| Published Report   | Mitchell, Joseph C. and J.M. Anderson. 1994. Amphibians and Reptiles of Assateague and Chincoteague Islands. Special Publication Number 2. Virginia Museum of Natural History. Martinsville, VA.                         |
| Unpublished Report | Mitchell, Joseph C., J.M. Anderson, and T.D. Schwaner. 1993. The Amphibians and Reptiles of Assateague Island National Seashore. Final Report to National Park Service. Assateague Island National Seashore. Berlin, MD. |
| Voucher Specimens  | ASIS museum collections including materials collected by Mitchell, Joseph C., J.M. Anderson, and T.D. Schwaner as part of 1993 Study   |
| Unpublished Data   | Occurrence records of marine turtles collected by ASIS resource management staff as part of marine animal stranding and salvage monitoring program, 1990-2001  |

### *Birds*

Overview of Status. A basic inventory of bird species occurring within ASIS is considered to be less than 90% complete. Species presence is documented by a wide variety of published and unpublished studies and anecdotal records that range from broad-based inventories to focused studies of individual species or guilds. The principle sources of inventory data are listed in Table 3. Voucher specimens from ASIS are not known to exist. With the exception of several rare species, information describing the distribution and abundance of bird species at ASIS is minimal.

Outstanding Needs. It is likely that adequate (>90% completeness) inventory data documenting the avifauna of ASIS exists, but needs to be “mined” and compiled. This effort would also serve to identify any significant data gaps and guide additional inventory efforts. Beyond basic species occurrence data, information describing the distribution and abundance of breeding birds is considered the highest priority need.

*Recommended action:* 1) Contract local/regional subject matter expert to identify, check, and synthesize existing inventory data and produce a summary document. 2) Contract subject matter expert to conduct breeding bird surveys of ASIS terrestrial habitats. Study should be structured to provide both basic presence/absence data, distribution and relative abundance of breeding avian species, and recommendations for long term monitoring.

Table 7. Bird Inventory Data for ASIS

| <b>Data Type</b>   | <b>Citation and/or Description</b>   |
|--------------------|--|
| Unpublished Report | Kirkpatrick, Roy L., E.E. Connor, and J.M. Morton. 1992. Waterfowl Population Assessment at Assateague Island National Seashore. Cooperative Agreement 4000-9-8014 SA 17. National Park Service. Philadelphia, PA. |
| Unpublished Data   | Occurrence records documenting migratory and resident shorebirds collected by ASIS resource management staff as part of long-term monitoring program, 1984-1996  |

## *Mammals*

Overview of Status. A basic inventory of mammalian species occurring within ASIS is considered to be less than 90% complete. Species presence is documented by one published report, one unpublished checklist, and unpublished data (Table 4). While some taxonomic groups may be adequately documented, others lack any information what so ever. Voucher specimens are not known to exist except in the case of certain marine mammals collected by the Smithsonian Institute (inadequate records at park). Information describing the distribution and abundance of mammalian species at ASIS is very minimal.

Outstanding Needs. Since the only systematic sampling of small mammals at ASIS occurred more than 35 years ago, it is probably appropriate to re-assess the endemic mammalian community. Efforts should focus on terrestrial species (including resident and transitory Chiroptera) and attempt to develop some measure of species distribution (among habitats) and relative abundance. *Recommended action:* 1) Identify subject matter experts to review existing ASIS and local/regional data and recommend course of action to address basic inventory needs for terrestrial species. 2) Contract subject matter expert to review and assess existing marine mammal occurrence data for adequacy in meeting basic inventory standards.

Table 8. Mammal Inventory Data for ASIS

| <b>Data Type</b>   | <b>Citation and/or Description</b>  |
|--------------------|---|
| Published report   | Paradiso, John L., and C.L. Handley, Jr. 1965. Checklist of Mammals of Assateague Island. Chesapeake Science, Vol. 6, No. 3, pp. 167-171                      |
| Unpublished Report | Bashore, Terry. 1990. A Checklist to the Mammals of Assateague Island. Unpublished Report. University of Maryland Eastern Shore. Princess Anne, MD.           |
| Park Monitoring    | Occurrence records of marine mammals collected by ASIS resource management staff as part of marine animal stranding and salvage monitoring program, 1990-2001 |

## *Fish*

Overview of Status. A basic inventory of fish species occurring within ASIS is considered to be greater than 90% complete. Species presence is documented by a wide variety of published and unpublished studies and unpublished data, primarily focused on the estuarine fish community (Table 5). Existing information describing the freshwater community is minimal, although data suggests that most fresh/brackish habitats are occupied by common estuarine species. A graduate thesis project is currently underway that should adequately document and describe the freshwater fish community. The marine community is thought to be reasonably well documented by existing regional characterizations (inadequate records at Park). Ongoing monitoring by the Maryland Department of Natural Resources is describing the distribution and abundance of fish in estuarine habitats both within and outside park boundaries. Voucher specimens of estuarine fish species may exist, but are unknown to the park.

Outstanding Needs. Assuming successful completion of the ongoing graduate thesis project describing ASIS freshwater ponds, the outstanding need is to evaluate the adequacy of existing data documenting the marine fish community. *Recommended action:* Contract subject matter expert to compile and assess existing regional characterization information and develop summary documentation.

Table 9. Fish Inventory Data for ASIS

| Data Type          | Citation and/or Description  |
|--------------------|--|
| Published Report   | Schwartz, Frank J. 1961. Fishes of Chincoteague and Sinepuxent Bays. The American Midland Naturalist 65 (2): 384-408   |
| Published Report   | Wiley, M.L., J.P. Chandler, and R. Hartman. 1970. The Finfish of Chincoteague Bay. Pages 296-355 in Assateague Ecological Studies, Part I: Environmental Information. Natural Resources Institute, University of Maryland Contribution Number 446. Chesapeake Biological Laboratory, Solomons, MD.   |
| Published Report   | Linder, C.C., J. Casey, S. Doctor, and A. Wesche. 1996. Maryland's Coastal Bays Shore Zone Fish Communities. In J.C. Chaillou et al. Assessment of the Ecological Condition of the Delaware and Maryland Coastal Bays. Appendix A. 1996. EPA/620/R-96/004. U.S. Environmental Protection Agency, Office of Research and Development. Washington, DC. |
| Unpublished Report | Casey, James F., R.C. Raynie, and A.E. Wesche. 1992. Investigation of Maryland's Atlantic Ocean and Coastal Bay Finfish Stocks. Federal Aid Project No. F-50-R-1. Maryland Department of Natural Resources, Tidewater Administration. Annapolis, MD.   |
| Unpublished Data   | Occurrence and abundance data from MD Department of Natural Resources long term monitoring of fish community structure in the MD Coastal Bays including Sinepuxent and Chincoteague Bays, 1972 to present.   |

## Cape Cod National Seashore

### *Vascular Plants*

Overview of Status. Documentation of the vascular plant species existing at CACO is considered to be 90% complete. Species presence is documented by numerous published reports, and voucher specimens housed in the park's museum collection (Table 10). A vegetation map will be developed for CACO in 2002-2004 and the vegetation plot data collected during this project will compliment the existing data.

Table 10. Vascular Plant Inventory Data for CACO.

| Citation and/or Description  |
|--|
| Wood, Jennifer 1993 Check list of plant species found at selected kettle pods. (Contains site references)  |
| Whatley, Michael E. Common Trailside Plants of Cape Cod National Seashore.   |
| Kamman, Neil C. 1989 Vegetation Communities of Cape Cod on Provincetown Forested and Dune lands.   |
| Shumway, Scott W. et al 1993 Interspecific Interactions Between Coastal Plants of Cape Cod National Seashore Progress Report and Proposal for Renewed Funding. |
| Art, Henry W. 1981 Report on the Vegetation of the Herring River System Cape Cod National Seashore Wellfleet, Massachusetts.                                   |
| Coe, James E. 1978. Wetlands Vegetation, A Report on the Establishment of Two Permanent Study Quadrats in North Truro, Massachusetts.                          |
| Dunwiddie, Peter W. & Harper, Karen A. 1993. Classification and Ranking of coastal Heathlands and Sandplain Grasslands Final Report.                           |
| Leblond, Richard 1988. Survey of Sandplain Grasslands and Heathlands on Cape Cod.  |
| Hinds, Harold Royal 1966. A Floristic Study of Outer Cape Cod, Massachusetts.  |
| Art, Henry W. 1990 Botanical Survey North Truro Air Force Station Cape Cod Barnstable County, Massachusetts.   |
| LeBlond, Richard 1989 Rare Vascular Plants of Cape Cod National Seashore.  |
| Disraeli, Donald J. et al 1979 Floral Reconnaissance of Selected Sites and Corridors: Eastham Area, Cape Cod National Seashore.                                |

### *Reptiles and Amphibians*

Overview of Status. The documentation of reptiles and amphibians occurring within CACO is considered to be complete (> 90%). While there is good information on the occurrence of amphibians and reptiles in the National Seashore, more work needs to be done to determine distribution, abundance, and population trends. Given the widespread declines in amphibians and reptiles that are being reported from many areas of the United States and beyond, this information is now more important than ever.

Outstanding Needs. The park supports populations of several species of Massachusetts State Listed Species. For some species, e.g. the spadefoot toad (*Scaphiopus h. holbrookii*), the park appears to be the most significant site in the state (Scott Melvin, MA. Natural Heritage Program, pers comm.). While the occurrence of species in the park has been documented, for many species, particularly the state-listed species, knowledge of the distribution, abundance, and habitat use is limited.

### Recommended Projects:

1. Inventory Spadefoot Toad Breeding Ponds. Spadefoot toad is a MA State Threatened Species for which Cape Cod National Seashore provides what appears to be the most significant site in Massachusetts. While their occurrence is well documented, primarily via road cruising, the actual breeding sites remain largely undocumented.



This project would identify, map, and characterize potential spadefoot breeding sites and employ call counts, minnow traps, and dipnetting to identify use by spadefoot toads.

2. Inventory Four-Toed Salamanders Breeding Ponds. The Four-toed salamander (Hemidactylium scutatum) is a Massachusetts Species of Concern that breeds in sphagnaceous-dominated temporary wetlands. While the occurrence of this species at CACO has been documented by a handful of records obtained primarily via nighttime road cruising, little is known of their breeding ponds. This project would identify, map, and characterize potential Four-toed salamander breeding ponds, and employ coverboards, minnow traps, and time constrained search to identify ponds used by this species.
3. Inventory Diamondback Terrapin populations and habitat use. The northern diamondback terrapin is a Massachusetts Threatened Species that reaches its northernmost limits at CACO, in Wellfleet Bay. While preliminary work has documented important nesting habitats (Shipley and Prescott 1989) accurate estimates of population size and knowledge of habitat use and distribution of animals within Wellfleet Bay are lacking. This project would partner with Massachusetts Audubon Society to provide mark/recapture estimates of population size, and employ radio-tracking/sonic-tagging to document habitat use by this species.

Table 11. Reptile and Amphibian Inventory Data for CACO

| Citation and/or Description   |
|---|
| Prescott, Robert, and Shipley, Stephanie 1989 Diamondback Terrapin Study of Wellfleet Harbor.   |
| Prescott, Rober L. 1980 Final Report for Faunal Reconnaissance of Selected Sites and Corridors Eastham Area Cape Cod National Seashore. (Contains mammals, birds and herps) |
| Lazell, James D. Jr. Cape Cod Reptiles and Amphibians: Distributions Known as of 23 August 1974.  |
| Higgins, Patti 1990. Cape Cod National Seashore Reptile and Amphibian Checklist.  |
| Colburn, Elizabeth A. 1999. Inventory and Monitoring of Amphibians of the Cape Cod National Seashore: A Preliminary Report to the US National Park Service.                 |
| Seipt, Irene 1987. An Inventory of the Eastern Spadefoot Toad and the Four-toed Salamander on Outer Cape Cod  |
| A List of Reptiles and Amphibians of Cape Cod based on field work by Marshal T. Case.   |
| Jones, Kyle L. 1992. Cape Cod National Seashore Reptile and Amphibian Survey.   |
| MHNP Rare species element occurrences at Cape Cod National Seashore. MNHP, Boston, MA 1992  |
| MA Herp Atlas Program Database, MAS, Lincoln, MA  |
| Amphibians and Reptiles of Cape Cod National Seashore, Robert P. Cook, 2001.  |

## *Birds*

Overview of Status. A basic inventory of bird species occurring within CACO is considered to be 90% complete. Species presence is documented by a wide variety of published and unpublished studies and anecdotal records that range from broad-based inventories to focused studies of individual species or guilds.

Outstanding Needs. It is likely that adequate (>90% completeness) inventory data documenting the avifauna of CACO exists, but needs to be “mined” and compiled. This effort would also serve to identify any significant data gaps and guide additional inventory efforts. Beyond basic species occurrence data, information describing the distribution and abundance of terrestrial breeding birds is considered the highest priority need.

### Recommended Projects:

1. Contract local/regional subject matter expert to identify, check, and synthesize existing inventory data and produce a summary document.
2. Contract subject matter expert to conduct breeding bird surveys of CACO terrestrial habitats. Study should be structured to provide both basic presence/absence data, distribution and relative abundance of breeding avian species.

Table 12. Bird Inventory Data for CACO

| Citation and/or Description   |
|---|
| Brown, Jennifer M. 1994. Species Composition, Migration Chronology, and Habitat Use of Waterbirds at Cape Cod National Seashore.  |
| An Ecological Analysis of Nauset Marsh, Cape Cod National Seashore. Birdlist.   |
| Status of grassland and heathland birds at Cape Cod National Seashore, MA. Shannon B. Kearney <sup>1</sup> , Americorps-Cape Cod, Robert P. Cook, Cape Cod National Seashore ,Wellfleet MA 02667, 2001  |
| Waterbird inventory and monitoring: Report on protocol implementation and development at Cape Cod National Seashore. 2001   |
| The 1999 annual report of the monitoring avian productivity and survivorship (MAPS) program in Cape Cod National Seashore. Peter Pyle, David F. DeSante, and Danielle R. O'Grady. The Institute for bird populations, Point Reyes Station, CA. Steven W. Hadden, CACO, NPS. |

## *Mammals*

Overview of Status. Inventory of mammalian species occurring within CACO is considered to be 90% complete. Small mammal monitoring began in 2000 in the park.

Table 13. Mammal Inventory Data for CACO.

| <b>Citation and/or Description</b>   |
|--|
| Small Mammal Monitoring at Cape Cod National Seashore. 2001. Robert P. Cook and Kelly Boland, Cape Cod National Seashore.  |
| List of Mammals of Cape Cod and Surrounding Waters based on field work by Marshal T. Case and Gordon L. Kirkland, Jr., supplemented by published reports and communications from reliable sources. |
| Spitzer, Numi C. The Cape Cod Mammal Survey: Summer, 1976  |
| Higgins, Patti 1990. Cape Cod National Seashore Mammal Checklist.  |
| Jones, Kyle 1990 Cape Cod National Seashore Rare Animal Checklist  |
| Prescott, Rober L. 1980 Final Report for Faunal Reconnaissance of Selected Sites and Corridors Eastham Area Cape Cod National Seashore.  |

### *Fish*

Overview of Status. A basic inventory of freshwater fish species occurring within CACO is considered to be 90% complete. A cooperative agreement (FY99) was established with Martha Mather of the University of Massachusetts to inventory freshwater fish in a number of parks in the Northeast. A final report for this survey is due in December, 2001.

Table 14. Fish Inventory Data for CACO.

| <b>Citation and/or Description</b>  |
|---|
| Jones, Kyle. 1990. Cape Cod National Seashore Freshwater Fish Checklist.                                      |
| Higgins, Patti 1990. Cape Cod National Seashore Saltwater Fish Checklist. (Contains attached list of inverts) |

### **Gateway National Recreation Area**

The Coastal and Barrier Network has hired a research associate through a cooperative agreement with the University of Rhode Island to data mine for species monitoring programs going on inside and adjacent to the Network parks. This project began in the summer of 2001 and is being funded through Network monitoring funds. The products from this project will include a database and report listing every species monitoring program associated with a network park as well as neighboring monitoring programs that parks could possibly take part in. Aside from this information, a great deal of species information has been collected that will be entered into NPSpecies. GATE, SAHI and FIIS are the first three parks in the Network to be worked on, and much of the information below is a result of this project. As evident from the amount of information collected so far, time now needs to be spent entering this data for each of these parks into NPSpecies. Once this is complete, identifying inventory gaps will be much more accurate.

## Birds

Overview of Status. Documentation of birds occurring within GATE is thought to be 90% complete. Species presence is documented by a wide variety of published and unpublished studies and anecdotal records that range from broad-based inventories to focused studies of individual species or guilds. Much of this data has yet to be entered into NPSpecies. Table 15 shows the documents sent to WASO in 1999 for the initial population of NPSpecies. No bird data has been entered since then. Table 16 provides some of the information found during data mining for GATE. This is just an example of how much existing data there is to be entered into the NPSpecies database.

Table 15. GATE Bird Inventory Data submitted to WASO to populate NPSpecies.

| Citation and/or Description  |
|--|
| Zuzworsky, J. Jamaica Bay I&M 1997: An Inventory and Monitoring Report for Gateway National Recreation Area's Breezy Point Jamaica Bay Unit. 1997. (Contains birds, reptiles, plants, fish and inverts)        |
| Lent, Richard A. Bird-Habitat Relationships as a Guide to Ecologically-Based Management at Floyd Bennett Field, Gateway National Recreation Area. Part III, Final Report. (Contains site references)           |
| Elbin, Susan B. et al. Status of Grassland Birds Breeding on Restored Grasslands at Floyd Bennett Field, Gateway National Recreation Area. Final Report. December 1998. (Contains site references, UTM Coords) |
| Davis, Thomas H. Birds of the Jamaica Bay Wildlife Refuge. February 1994.  |
| Bourque, Ronald et al. Birds of Floyd Bennett Field. March 1994.   |
| Cole, Richard C. Sandy Hook – Urban Wilderness. 1977. (Contains plants and birds)  |

Table 16. GATE Bird Inventory and Monitoring Information compiled during network data mining project, 2001.

|                            | Citation and/or Description   |
|----------------------------|---|
| <b>Various Bird Spp</b>    | Important Bird Areas designated by Audubon Society -Jamaica Bay Complex. Website lists birds and some abundance data. (Jamaica Bay Complex) Data sources include Gateway National Park and the NY City Audubon Chapter.                                 |
|                            | NYSDEC Breeding Bird Atlas (1980-1985)- data available online. Lists bird species observed in 3X3mi quad in GATE.   |
|                            | NYSDEC Breeding Bird Atlas (2000- will end in 2004) To be produced once all data is collected. Uses same methodology as 1980-85 NYSDEC BBA.   |
| <b>Passerines</b>          | Karlson, K. 1989. Sandy Hook fallout. <i>New Jersey Audubon Society Records of New Jersey Birds</i> 15:2.   |
| <b>Colonial Waterbirds</b> | Buckley, P.A. and F.G. Buckley. 1980. Population and colony-site trends of Long Island waterbirds for five years in the mid-1970s. <i>Transactions of the Linnaean Society of New York</i> 9:23-56. Aerial surveys on Long Island. ? locations on FHS   |
|                            | Long Island colonial waterbird and piping plover survey. Annual survey since 1982. A cooperative effort of the NYSDEC, The Nature Conservancy, U.S. Fish and Wildlife Service, Audubon chapters. Annual reports are produced and distributed by NYSDEC. |
|                            | Harbor Herons Project. (1986-1990) Kathy Parsons- Manomet Bird Observatory. Surveyed wader colony sites and surrounding wetland habitat including some islands in GATE.   |
|                            | U.S. Fish and Wildlife Service: National Atlas of Coastal Waterbird Colonies in the   |

|                |   |
|----------------|---|
|                | Contiguous United States:1976-1982. Covered the Atlantic coast of the northeastern United States (including Long Island). Known reports include: (Erwin and Korschgen 1979) for 1977 atlas; 1984-1985 (Andrews 1990);1994-1996 (USFWS).   |
|                | NJ Colonial Waterbird Numbers. (1976-1989) Rutgers University. Visual survey within or on the edge of colony.   |
|                | Colonial Waterbird Monitoring of NY and NJ coastal areas-(1971-1990)) Rutgers University. All colonies in NJ and selected colonies on western LI/ground surveys   |
|                | USFWS 1973-2000. Mid-winter waterfowl surveys Annual aerial waterfowl counts performed at all major waterfowl concentration areas including Jamaica Bay   |
|                | Federation of NY State Bird Clubs- Mid-winter waterfowl surveys in New York 1955(1968-1972 no data)-present. Ground surveys of Jamaica Bay are being confirmed. Don Riepe at Gateway has been conducting winter counts as part of the Federation of Bird Clubs annual count.  |
|                | NYSDEC. Undated. Brant surveys. Bureau of Wildlife, Stony Brook, NY.  |
|                | Burger, J., R. Trout, W. Wander, and G.S. Ritter. 1984. Jamaica Bay studies 7: Factors affecting the distribution and abundance of ducks in a New York estuary. <i>Estuarine, Coastal and Shelf Science</i> 19:673-689.   |
| Shorebirds     | Fall shorebird migration at Jamaica Bay Wildlife Refuge (1981-1988)   |
|                | Fall shorebird migration at GATE (1970's-1980's) Brian Harrington-Manomet Bird Observatory. Determined species and abundance.   |
| Breeding Birds | Burger, J. and M. Gochfeld. 1983. Jamaica Bay studies 5: Flocking associations and behavior of shorebirds at an Atlantic coastal estuary. <i>Biology of Behavior</i> 8:289-318.   |
| Seabirds       | Buckley, P.A., and F.G. Buckley. 1984. Seabirds of the North and Middle Atlantic coasts of the United States: their status and conservation. Pp. 101-133 in Croxall, J., P. Evans and R. Schreiber, eds. Status and conservation of the world's seabirds. ICBP Technical Report No. 2. Cambridge, England, ICBP. 778pp. |

### *Amphibians and Reptiles*

Overview of Status. Documentation of amphibians and reptiles occurring within GATE is thought to be 90% complete. Herpetological inventories will begin at GATE in 2002 through a cooperative agreement with the Wildlife Conservation Society's John Behler and NPS staff Bob Cook, CACO. An amendment to this agreement was established in FY01 to refine inventory work to specific species such as Fowler's toads and hognose snakes at Sandy Hook, Diamondback Terrapins at Sandy Hook and Box turtles at Floyd Bennet Field. Table 17 provides the list of documents pertaining to amphibians and reptiles was used to populate NPSpecies. No herp data has been entered since then. Table 18 provides information found during the network data mining project for GATE.

Outstanding Needs. Two additional inventory projects have been identified by both John Behler of the Wildlife Conservation Society and Robert Cook of Cape Cod National Seashore, for GATE. They include an inventory of amphibian populations at the Jamaica Bay Wildlife Refuge and an inventory of Fowler's Toad and hognose snakes at the Breezy Point District. Funding for these projects is being requested in this study plan. It will be much more economical to complete these projects at this time considering field crews will be working at the park on general herpetological inventories beginning in 2002.

Table 17. GATE amphibian and reptile Inventory Data submitted to WASO to populate NPSpecies.

| Citation and/or Description  |
|--|
| Cook, Robert P. "And the Voice of the Grey Tree Frog...". Park Science, Vol. 9, Spring 1989.   |
| Cook, Robert P. Movement and Ecology of Eastern Box and Painted Turtles Repatriated to Human-Created Habitat. 1996. Information for only one turtle species. |
| Cook, Robert P. Amphibians and Reptiles – Gateway National Recreation Area. September 1989. (Contains some site references)                                  |
| Cook, Robert P. Amphibians, Reptiles and Mammals of the Jamaica Bay Wildlife Refuge. October 1989.   |
| Zuzworsky, J. Jamaica Bay I&M 1997: An Inventory and Monitoring Report for Gateway National Recreation Area's Breezy Point Jamaica Bay Unit. 1997.           |

Table 18. GATE amphibian and reptile inventory and monitoring information compiled during network data mining project, 2001.

| Citation and/or Description  |
|--|
| Herpetological and Mammal Survey at GATE in Summer of 2000. Specific site in park unknown. Hofstra University -Russell Burke   |
| Feinberg, Jeremy A. 2000. Nesting ecology of Diamondback Terrapins ( <i>Malaclemys terrapin</i> ) at Gateway National Recreation Area. M.S. Thesis. (Hofstra University). Contains site references particularly Ruler's Bar Hassock  |
| Feinberg, Jeremy A. and Russell Burke. ?date(within last two years). Nesting ecology, Habitat Use and Distribution of Diamondback Terrapins ( <i>Malaclemys terrapin</i> ) at Gateway National Recreation Area. (Hofstra University).  |
| Feinberg, Jeremy A and Russell Burke. ?date (within last two years) A Study of Predation on Diamondback Terrapin ( <i>Malaclemys terrapin</i> ) Eggs and Adults at Jamaica Bay Wildlife Refuge.  |
| Ner, Sylwia. ? Predators and predation rates at Jamaica Bay Wildlife Refuge. A study regarding predation rates of Diamondback Terrapins at ( <i>Malaclemys terrapin</i> ) other sites within GNRA. Sites located within include Breezy Point Unit of GNRA are Elder's Point, Pumpkin Patch, Subway Island, Ruffle Bar, Canarsie Pol, Little Egg Marsh, and Ruler's Bar Hassock. Plans are to also survey birds and mammals of these islands.(Hofstra University) M.S. Thesis-should be complete in near future-pers. communication with R. Burke |
| NYSDEC Amphibian and Reptile Atlas (1990-1999).  |
| U.S. Department of the Interior. 1992. Amphibians and reptiles. Pamphlet for Gateway National Recreation Area, National Park Service.  |
| Morreale, S.J. and E.A. Standora. 1993. Occurrence, movement, and behavior of the Kemp's Ridley and other sea turtles in New York waters. Final Report. Okeanos Ocean Research Foundation, Hampton Bays, New York. 70 pp.  |
| Morreale, S.J. 1992. The status and population ecology of the diamondback terrapin in New York. Prepared by the Okeanos Ocean Research Foundation for the New York State Department of Environmental Conservation and The Nature Conservancy, South Fork/Shelter Island chapter.   |

## *Mammals*

Overview of Status. Documentation of mammals occurring within GATE could be 90% complete in specific units in the park, but further assessment of existing mammal data needs to be completed. Much of the mammal work done at GATE was done in the '80's. Some Live trapping was conducted in the early 1990's at Floyd Bennett Field as part of a Hantavirus survey conducted at numerous NPS sites by the Univ. of Arizona and some more recent work was conducted by Russell Burke of Hofstra University. Burke recently did some pitfall trapping around Jamaica Bay. As evident in table 19, NPSpecies only contains data from the 1980's, this more recent data needs to be obtained and entered. Table 20 lists further inventory and monitoring projects identified during data mining for GATE. Any associated data from these projects has yet to be entered into the database.

Table 19. GATE mammal inventory data submitted to WASO to initially populate NPSpecies.

| Citation and/or Description   |
|---|
| Cook, Robert P. Mammals – Gateway National Recreation Area. September 1989. (Contains some site references) (U.S. Department of the Interior. 1989. Mammals. Pamphlet for Gateway National Recreation Area, National Park Service.) |
| Cook, Robert P. Amphibians, Reptiles and Mammals of the Jamaica Bay Wildlife Refuge. October 1989.  |
| O'Connell, Allan. The Relationships of Mammals to the Major Vegetation Communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point, and Sandy Hook). February 1980.                                  |

Table 20. GATE mammal inventory and monitoring information compiled during network data mining project, 2001.

| Citation and/or Description  |
|--|
| Sadove, S. and P. Cardinale. 1993. Species composition and distribution of marine mammal and sea turtles in the New York Bight. Final report to U.S. Fish and Wildlife Service, Southern New England - New York Bight Coastal Ecosystems Program, Charlestown, RI. |
| Herpetological and Mammal Survey at GATE in Summer of 2000. Specific location in park unknown. Hofstra University -Russell Burke   |

## *Fish*

Overview of Status. The percent of documented fish species occurring at GATE is unclear, again, further assessment of existing fish data needs to be completed.

Table 21. GATE fish inventory data submitted to WASO to initially populate NPSpecies.

| Citation and/or Description   |
|---|
| Scaglione, E. Ann. Jamaica Bay Fisheries Survey. 1985-1986, 1988-1989.  |
| Riepe, Don et al. Finfish of Jamaica Bay. 1986. (Contains some site references)   |
| Zuzworsky, J. Jamaica Bay I&M 1997: An Inventory and Monitoring Report for Gateway National Recreation Area's Breezy Point Jamaica Bay Unit. 1997. (Contains birds, reptiles, plants, fish and inverts) |

Table 22. GATE fish inventory and monitoring information compiled during network data mining project, 2001.

| Citation and/or Description   |
|---|
| Fish Tagging Program sponsored by the American Littoral Society (1965 to present) monitors coastal fish movement through data collected by saltwater anglers. Various locations off coast of GATE. (Carlsen, Pam. 2000. Fish Tagging Report of the American Littoral Society. Underwater Naturalist. Volume 25, Number 3: Unk pp.)  |
| Briggs, P.T. 1962. The sport fisheries of Great South Bay and vicinity. New York Fish and Game Journal 9 (1): 1-36  |
| McEnroe, M. and P. M. Woodhead. 1991. Fisheries of the estuary: status, trends and change. A report on Task 5.3 of the New York/New Jersey Harbor Estuary Program.  |
| New York State Department of State. 1987. Significant coastal fish and wildlife habitats program. Habitat narratives for Beaverdam Creek, Carmans River, Cedar Beach, Champlin Creek, Connetquot River, Gilgo Beach, Great South Bay-East, Great South Bay-West, Orowoc Creek, Sore Thumb, Swan River. New York State Department of State, Division of Coastal Resources and Waterfront Revitalization, Albany, NY. |
| New York State Department of State, Division of Coastal Resources and Waterfront Revitalization. 1992. Significant coastal fish and wildlife habitats program, Jamaica Bay habitat narrative, Breezy Point habitat narrative.   |
| Wilk, S.J., W.W. Morse, D.E. Ralph, and T.R. Azarovitz. 1977. Fishes and associated environmental data collected in the New York Bight, June 1974-75. U.S. Department of Commerce, National Oceanic and Atmospheric Administration technical report, National Marine Fisheries Service, special scientific report SSRF-716. 53 p.   |
| Woodhead, P. M. and M. McEnroe. 1991. Habitat use by the fish community. A report on Task 5.1 of the New York/New Jersey Harbor Estuary Program. Marine Services Research Center, State University of New York, Stony Brook, NY.  |
| Woodhead, P.M. 1991. Inventory and characterization of habitat and fish resources, and assessment of information on toxic effects in the New York - New Jersey Harbor estuary. A report to the New York/New Jersey Harbor Estuary Program, concerning work in Tasks .32, 5.1 and 5.3. Marine Services Research Center, State University of New York, Stony Brook, NY.   |
| Young, B.H., K. A. McKown, V.J. Vecchio, K. Hattala, 1992. A study of striped bass in the marine district of New York VI. Completion Report AFC-16, jobs 1-4. New York Department of Environmental Conservation, Division of Marine Resources, Stony Brook, NY. Mimeographed.   |



## *Vascular Plants*

Overview of Status. Vascular plant surveys of GATE are considered to be 90% complete. Les Mehrhoff a botanist of the University of Connecticut Herbarium is reviewing the existing plant data for GATE. This project is part of a larger project that includes the Northeast Temperate Network parks as well as FIIS and SAHI. He is reviewing NPSpecies plant data for these parks, editing records, adding status and abundance documentation for each species, and determining the percentage of species documented. Once this project has been completed data gaps will be more easily identifiable. It could be determined that data gaps exist within individual units of Gateway, but at this time, no specific projects involving vascular plants have been identified. Table 23 lists the documentation for plant species in NPSpecies and table 24 provides a few more references identified during the data mining process. It appears that the most significant references for plants were identified and submitted to WASO to be entered into NPSpecies.

Vegetation mapping of GATE will begin in 2002. The vegetation plot data from this project should provide the park with a list of approximately 75% of the existing plant species at GATE.

Table 23. GATE vascular plant inventory data submitted to WASO to initially populate NPSpecies.

| <b>Citation and/or Description</b>  |
|---|
| Stalter, Richard et al. "Rare and Endangered Plants at Gateway National Recreation Area: a case for protection of urban natural areas". Landscape and Urban Planning 35 (1996) 41-51.                   |
| Cook, Robert P. Flora of Gateway National Recreation Area. 1997. (Contains site references)   |
| Hartig, Ellen et al. Phragmites Fire Ecology.   |
| Rogers, G.F. et al. Rate of <i>Myrica pennsylvanica</i> (bayberry) expansion in grassland at Gateway National Recreation Area, New York. August 1984.   |
| Stalter, Richard. Plant Communities on Four Landfill Sites, New York.   |
| Cerniglia, Paul. Plant Species Inventory and Tree Population Survey Within the Sewer Line Right-of-Way at the Swamp White Oak Forest. August 1982.  |
| Stalter, R. et al. Some Botanical Observations of the Swamp White Oak Forest, Staten Island Unit, Gateway National Recreation Area. 1982.   |
| O'Connell, Allan. The Relationships of Mammals to the Major Vegetation Communities in Gateway   |
| Zuzworsky, J. Jamaica Bay I&M 1997: An Inventory and Monitoring Report for Gateway National Recreation Area's Breezy Point Jamaica Bay Unit. 1997. (Contains birds, reptiles, plants, fish and inverts) |
| Cole, Richard C. Sandy Hook – Urban Wilderness. 1977. (Contains plants and birds)   |

Table 24. GATE vascular plant inventory and monitoring information compiled during network data mining project, 2001.

| Citation and/or Description  |
|--|
| Chrysler, M.A., The origin and development of the vegetation of Sandy Hook. <i>Bulletin of the Torrey Club</i> . 1930. Volume 57 pp. 163-176.  |
| NY Natural Heritage Program List of Rare Species (early 1900's to present) Lists state R,T,E; plants and birds of GATE. Inventory from various locations on GATE Seabeach Amaranth Surveys: Per communication with Steve Young, botanist with the NY Natural Heritage Program, Seabeach Amaranth surveys are being conducted at GATE by S. Gilmore, NPS staff, GPS points and summary. |
| Jones, C.R. and J.R. Schubel. 1978. Distribution of surficial sediments and eelgrass in New York's South Shore Bays: an assessment from the literature. Special report 13, reference 78-1, Marine Sciences Research Center, State University of New York, Stony Brook, NY.   |
| Salzman, L. 1994. Extirpated and endangered flora and fauna of the lower Hudson estuary. New York City Department of Environmental Protection, Valhalla, NY.   |
| Stalter, R. 1979. Some ecological observations on an <i>Ilex</i> forest, Sandy Hook, New Jersey. <i>Castanea</i> 44:202-207.   |
| Stalter, R. undated. Rare plants of Gateway National Recreation Area, New York, New Jersey: a report for the National Park Service. Unpublished report.  |
| U.S. Department of the Interior. 1993. Draft Gateway National Recreation Area inventory of submerged natural resources and review of key issues. National Park Service Grant #2000917, National Park Service, Gateway National Recreation Area. Brooklyn, NY.  |
| U.S. Fish and Wildlife Service. 1995. Technical/agency draft recovery plan for seabeach amaranth ( <i>Amaranthus pumilus</i> Rafinesque). Southwest Region, Atlanta, GA.   |
| Venezia, K. and R. Cook. 1991. Flora of Gateway National Recreation Area. U.S. Department of the Interior. Unpublished report. 39 p.   |
| New Jersey Audubon Society. 1991. Arthur Kill wildlife and habitat inventory. New Jersey Audubon Society report to New Jersey Conservation Foundation, Bernardsville, NJ.  |

## Fire Island National Seashore

### *Birds*

Overview of Status: The documentation of avian species at FIIS is considered to be 90% complete. Dr. Paul Buckley, USGS-BRD, has studied birds on Fire Island for many years. As a taxa expert for the park he feels that 90% of the existing species at Fire Island have been documented, and that further inventory work at this time is not a priority.

Outstanding Needs: At this time, NPSpecies contains data on avian species from only two references listed in table 25. Table 26 provides references identified during the species inventory and monitoring data mining project for the Network. A priority at this time will be to gather all of this existing data, and enter it into the NPSpecies. Once this is complete a taxa expert such as Dr. Buckley will be asked to review the data and identify any further gaps in inventory.

Table 25. FIIS bird inventory data submitted to WASO to initially populate NPSpecies.

| Citation and/or Description  |
|--|
| Lynch, Patrick. Ecological Inventory: William Floyd Estate, Fire Island National Seashore. (Contains plants, mammals, herps and birds) |
| Birds of Fire Island National Seashore. 1999. Mitra, S. and Putnam, J  |

Table 26. FIIS bird inventory and monitoring information compiled during network data mining project, 2001.

|                            | Citation and/or Description  |
|----------------------------|--|
| <b>Various Species</b>     | Comprehensive Monitoring Study at Wm. Floyd Estate: Annual surveys to include water tables, salinity levels, vegetation characteristics, invertebrates including mosquitos, birds and fish. Data collection began in Fall 1999. Cooperative effort with USGS/USFWS/Moriches Bay Audubon Society. Note: USFWS wants to expand this study to include FIIS as well. |
|                            | NY Natural Heritage Program List of Rare Species (early 1900's to present) Lists state R,T,E; plants and birds of FIIS. Inventory from various locations on FIIS.  |
|                            | Important Bird Areas designated by Audubon Society Fire Island (east of lighthouse), Moriches Bay and Great South Bay, Captree Island vicinity. Website lists birds and some abundance data. Audubon is sending sources of data. Most waterfowl data is from NYSDEC annual Mid-Winter waterfowl surveys.   |
|                            | NYSDEC Breeding Bird Atlas (1980-1985)- data available online. Lists all bird species observed and 3X3mi quad on FIIS where it as located. Some quads may include adjacent lands outside of NPS land.  |
|                            | NYSDEC Breeding Bird Atlas (2000- will end in 2004) To be produced once all data is collected. Uses same methodology as 1980-85 NYSDEC BBA.  |
|                            | Christmas Bird Counts including Captree Christmas Bird Count which covers Great South Bay (backside of FIIS and some of FIIS)  |
| <b>Passerines</b>          | P.A. Buckley. Neotropical Migrants on Fire Island (1969-1972). Conducted at the undeveloped Lighthouse Tract on FIIS. Passerines mist-netted. Bird species and abundance recorded. Complete Bibliography not found.  |
|                            | P.A. Buckley. Assessing declines in Neotropical migrants on Fire Island NS: Phase II. Compare bird species richness and abundance to prior study   |
| <b>Breeding Birds</b>      | Andrle, R. F. and J. R. Carroll (eds.) 1988. The Atlas of Breeding Birds in New York State. Cornell University Press, Ithaca, N.Y.   |
| <b>Colonial Waterbirds</b> | Buckley, P.A. and F.G. Buckley. 1980. Population and colony-site trends of Long Island waterbirds for five years in the mid-1970s.   |
|                            | Long Island colonial waterbird and piping plover survey. Annual survey since 1983. A cooperative effort of the Department, The Nature Conservancy, U.S. Fish and Wildlife Service, Audubon chapters. Annual reports are produced and distributed by NYSDEC. NPS staff assist with gathering data at FIIS   |
|                            | Piping Plover /Least Tern Protection and Monitoring Program administered by Suffolk County Parks at Smith Point County Park (eastern tip of FIIS) (1998-present)   |
|                            | U.S. Fish and Wildlife Service: National Atlas of Coastal Waterbird Colonies in the Contiguous United States: 1976-1982.   |
|                            | Erwin, R.M. and C.E. Korschgen. 1979. Coastal waterbird colonies: Maine to Virginia, 1977. An atlas showing colony locations and species composition. U.S. Fish and Wildlife Service, Biological Services Program, FWS/085-79/08.  |
|                            | USFWS. 1998. Atlantic coast colonial waterbird nesting data 1994-1996. USFWS Migratory Bird Office, Patuxent, MD.  |

|                   |   |
|-------------------|---|
| <b>Water Fowl</b> | USFWS Waterfowl Surveys of the 1960's-extensive ground and aerial waterfowl surveys were conducted in the Great South Bay and Moriches Bay (including FIIS) in the 1960's for the U.S. Army Corps of Engineers as part of the Fire Island Cooperative Beach Erosion Control and Hurricane Protection Project (USFWS 1965, 1969a, and 1969b) |
|                   | USFWS 1973-2000. Mid-winter waterfowl surveys included Great South Bay, Moriches Bay and FIIS Inlet. Annual aerial waterfowl counts performed at all major waterfowl concentration areas.   |
|                   | Federation of NY State Bird Clubs- Mid-winter waterfowl surveys in New York 1955(1968-1972 no data)-present. Ground surveys of Great South Bay, Moriches Bay and FIIS inlet.  |
|                   | NYSDEC. Undated. Brant surveys. Bureau of Wildlife, Stony Brook, NY.  |
|                   | USFWS (U.S. Fish and Wildlife Service). 1973-2000. Mid-winter waterfowl survey - Atlantic Flyway data. Office of Migratory Bird Management, Laurel, MD.   |
| <b>Raptors</b>    | Hawk banding station located near FIIS lighthouse administered by Theodore Roosevelt Sanctuary  |

### *Amphibians and Reptiles*

Overview of Status: As part of a cooperative agreement with the Wildlife Conservation Society, a complete inventory of amphibians and reptiles will be completed in 2000-2002. Very little work on amphibians and reptiles has been completed at FIIS as evident by the references and lack of data uncovered during the network data mining project. Currently there are two species of amphibian listed in NPSpecies. This much needed inventory by the Wildlife Conservation Society and NPS staff will fill a large information gap for the park and help to identify further herpetological projects. Once the project is complete, the data will be reviewed and the percentage of species documented in the park will be determined.

Table 27. FIIS amphibian and reptile inventory data submitted to WASO to initially populate NPSpecies.

| <b>Citation and/or Description</b>   |
|--|
| Lynch, Patrick. Ecological Inventory: William Floyd Estate, Fire Island National Seashore. (Contains plants, mammals, herps and birds) |

Table 28. FIIS amphibian and reptile inventory and monitoring information compiled during network data mining project, 2001.

| <b>Citation and/or Description</b>  |
|---|
| Drift fence survey of Amphibians and Reptiles on FIIS (?1998 or 1999) personal communication with Russell Burke   |
| NYSDEC Amphibian and Reptile Atlas (1990-1999).   |
| South Shore Estuary Reserve Marine Turtles, Diamondback Terrapin, Mud Turtles and Seals Draft Technical Report. 1998. NYDEC and USFWS: USFWS and NYDEC recommend that the eastern mud turtle ( <i>Kinosternon subrubrum</i> ) is a species that warrants study. NY State has it listed as a threatened species. Only four in NY State. One is located at FIIS on the north side of the barrier beach near |

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| Whale House Point.   |
| Morreale, S.J. 1992. The status and population ecology of the diamondback terrapin in New York. Prepared by the Okeanos Ocean Research Foundation for the New York State Department of Environmental Conservation and The Nature Conservancy, South Fork/Shelter Island chapter. |

### *Mammals*

**Overview of Status:** As a taxa expert and a FIIS staff member, Ernest Taylor has spent time reviewing the park's existing mammal data and feels that 90% of the existing species have been documented. Ernie has a background in mammalogy and wildlife biology. He has described Fire Island as having very complete small mammal data, including population densities for all common species as well as habitat associations based on vegetation classification work done by McCormick et al. (1975). Ernie plans to do some work in the park to fill in distributional gaps in mammal information and to gather further information on insectivores.

Table 29. FIIS mammal inventory data submitted to WASO to initially populate NPSpecies.

| <b>Citation and/or Description</b>   |
|--|
| Lynch, Patrick. Ecological Inventory: William Floyd Estate, Fire Island National Seashore. (Contains plants, mammals, herps and birds)   |
| Art, Henry W. The Impacts of Deer on the Sunken Forest and Fire Island National Seashore Fire Island, NY. 1967-1989. May, 1990. (Contains plant list)  |
| Northup, James G. North Atlantic Region Office of Scientific Studies. 1986.  |
| O'Connell, A. F., Sayre, M.W. 1989. White-tailed deer management study: Fire Island National Seashore. Patchogue, NY.  |
| McCormick, J. 1975. Environmental inventory of the Fire Island National Seashore and the William Floyd Estate, Suffolk County, New York. National Park Service, Denver Service Center, Denver, CO. |
| Fischer, J.P. Taylor, E. 2000.   |

Table 30. FIIS mammal inventory and monitoring information compiled during network data mining project, 2001.

| <b>Citation and/or Description</b>  |
|---|
| From South Shore Estuary Reserve Marine Turtles, Diamondback Terrapin, Mud Turtles and Seals Draft Technical Report. 1998. NYDEC and USFWS: A variety of seals use Fire Island Inlet for haul-outs and foraging. All seals are federally protected under the <i>Marine Mammals protection Act</i> . The species include harbor seals ( <i>Phoca vitulina</i> ), grey seals ( <i>Halichoerus grypus</i> ), ringed seals ( <i>Phoca hipida</i> ), harp seals ( <i>Phoca groenlandica</i> ) and hooded seals ( <i>Cystophora cristata</i> ). |
| Sadove, S. and P. Cardinale. 1993. Species composition and distribution of marine mammal and sea turtles in the New York Bight. Final report to U.S. Fish and Wildlife Service, Southern New England - New York Bight Coastal Ecosystems Program, Charlestown, RI.  |
| Underwood, H. B. 1991. Trends in relative abundance and growth rates of white-  |

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| tailed deer on Fire Island National Seashore. Unpublished Report to Fire Island National Seashore. 18pp. +1 table, 3 figures, 1 appendix.                                |
| Underwood, H.B., F.D. Verret, and J.P. Fischer. 1998. Density and herd composition of White-tailed deer populations of Fire Island National Seashore. Report to the NPS. |

## *Fish*

**Overview of Status:** The only data on fish species for FIIS that was entered into the NPSpecies database is from an environmental inventory done in the park in 1975 by J. McCormick. Other data was found during the Network data mining project, but it is not clear whether or not this data will be useful in identifying gaps.

**Outstanding Needs:** A taxa expert will be identified to review the existing data for the park and determine what gaps exist.

Table 31. FIIS fish inventory and monitoring information compiled during network data mining project, 2001.

| <b>Citation and/or Description</b>  |
|---|
| Fish Tagging Program sponsored by the American Littoral Society (1965 to present) monitors coastal fish movement through data collected by saltwater anglers. Various locations off FIIS coast and backwaters.  |
| Briggs, P.T. 1962. The sport fisheries of Great South Bay and vicinity. New York Fish and Game Journal 9 (1): 1-36  |
| New York State Department of State. 1987. Significant coastal fish and wildlife habitats program. Habitat narratives for Beaverdam Creek, Carmans River, Cedar Beach, Champlin Creek, Connetquot River, Gilgo Beach, Great South Bay-East, Great South Bay-West, Orowoc Creek, Sore Thumb, Swan River. New York State Department of State, Division of Coastal Resources and Waterfront Revitalization, Albany, NY. |
| South Shore Estuary Reserve. 1997. Diadromous Fish Draft Technical Report, October 24, 1997. New York State Department of State, Albany, N.Y., and the USFWS, Charlestown, R.I.   |
| Bokuniewicz, H.A., A. McElroy, C. Schlenk and J. Tansji, editors, 1993. Estuarine resources of the Fire Island National Seashore and Vicinity. New York Sea Grant Institute, SUNY-Stony Brook, Stony Brook, NY. 79p (plus appendices).  |
| South Shore Estuary Reserve. 1998. Estuarine Fishes Draft Technical Report, July 30, 1998. New York State Department of State, Albany, N.Y., and the USFWS, Charlestown, R.I.   |
| Young, B.H., K. A. McKown, V.J. Vecchio, K. Hattala, 1992. A study of striped bass in the marine district of New York VI. Completion Report AFC-16, jobs 1-4. New York Department of Environmental Conservation, Division of Marine Resources, Stony Brook, NY. Mimeographed.   |
| Smith, C. L. 1985. <i>The inland fishes of New York State</i> . New York State, Department of Environmental Conservation, Albany, NY.   |
| Stone, S.L., T.A. Lowery, J.D. Field, C.D. Williams, D.M. Nelson, S.H. Jury, M.E. Monaco, and L. Andreasen. 1994. Distribution and abundance of fishes and invertebrates in mid-Atlantic estuaries. ELMR Rep. No. 12. National Oceanic and Atmospheric Administration/NOS Strategic Environmental Assessments Division, Silver Spring, MD. 280 p.   |

## Vascular Plants

Overview of Status. Vascular plant surveys of FIIS are considered to be 90% complete. Les Mehrhoff a botanist from the University of Connecticut Herbarium is reviewing the existing plant data for FIIS. This project is part of a larger project that includes the Northeast Temperate Network parks and three Coastal parks, FIIS, GATE and SAHI. He is reviewing NPSpecies plant data for these parks, editing records, adding status and abundance documentation for each species, and determining the percentage of species documented. Once this project has been completed data gaps will be more easily identifiable. It may be determined that data gaps exist within individual units of FIIS, but at this time, no specific projects involving vascular plants have been identified. Table 32 lists the references for plant species currently entered into NPSpecies. These were the documents sent to WASO in 1999. Table 33 provides a few more references identified during data mining for the park, some of which should have been included in the initial population of NPSpecies for the park, i.e., Stalter et al., *Vegetation of Fire Island*.

A vegetation map was recently completed for FIIS. The vegetation plot data from this project may add a considerable number of species to the current NPSpecies list.

Table 32. FIIS vascular plant inventory data submitted to WASO to initially populate NPSpecies.

| Citation and/or Description   |
|---|
| Frerichs, Mollie G. and Gaudet, John J. The Biology of Aquatic Plant Life in Eastern Long Island. A key to algae, mosses and liverworts.              |
| Lynch, Patrick. Ecological Inventory: William Floyd Estate, Fire Island National Seashore. (Contains plants, mammals, herps and birds)                |
| Northup, James. A Progress Report on the Ecological Inventory Project - Fire Island Seashore. February 1986. (Plants)                                 |
| Anders, Fred J. et al. Final Report on The Effects of Off-Road Vehicles on Beach and Dune Systems: Fire Island National Seashore. 1981. (Plants)      |
| Art, Henry W. The Impacts of Deer on the Sunken Forest and Fire Island National Seashore Fire Island, NY. 1967-1989. May, 1990. (Contains plant list) |

Table 33. FIIS vascular plant inventory and monitoring information compiled during network data mining project, 2001.

| Citation and/or Description   |
|---|
| NY Natural Heritage Program List of Rare Species (early 1900's to present) Lists state R,T,E; plants and birds of FIIS. Inventory from various locations on FIIS.                   |
| Seabeach Amaranth Surveys: Per communication with Steve Young, botanist with the NY Natural Heritage Program, Seabeach Amaranth surveys are being conducted at FIIS by James Ebert. |
| Art, II W. 1976. Ecological Studies of the Sunken Forest, Fire Island National Seashore, New York. National Park Service Scientific Monograph Series Number 7, xv +237p.            |
| Dowhan, J.J. and R. Rosza. 1989. Flora of Fire Island, Suffolk County, New York. <i>The Bulletin of the Torrey Botanical Club</i> 116(3):256-282.                                   |

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| Sirken, L.A.. 1972. Origin and history of Maple Bog in the Sunken Forest, Fire Island, New York. <i>The Bulletin of the Torrey Botanical Club</i> 99(3):131-135.   |
| Stalter, R., E.E. Lamont, and J. Northrup. 1986. Vegetation of Fire Island, New York. <i>Bulletin of the Torrey Botanical Club</i> 113(3):298-306.   |
| U.S. Fish and Wildlife Service. 1995. Technical/agency draft recovery plan for seabeach amaranth ( <i>Amaranthus pumilus</i> Rafinesque). Southwest Region, Atlanta, GA.   |
| Jones, C.R. and J.R. Schubel. 1980. Distributions of surficial sediment and eelgrass in Great South Bay, New York (from Smith Point west to Wantagh State Parkway). Special report 39, reference 80-6, Marine Sciences Research Center, State University of New York, Stony Brook, NY. |

### ***Assessing inventory needs for COLO, THST and GEWA***

On April 6, 2001, COLO, THST and GEWA took part in a scoping workshop held in Virginia along with six VA Mid-Atlantic Network parks, RICH, FRSP, BOWA, APCO, PETE, SHEN and the Appalachian Trail. The scoping workshop was held to allow local taxa experts to meet and assist these parks in formulating plans to inventory vertebrate and vascular plants. The workshop included representatives from the VA Department of Recreation and Conservation Natural Heritage Program, VA Department of Game and Inland Fisheries, Frostburg University, VA Commonwealth University, the University of Richmond, William and Mary, USGS-Patuxent, and others (Appendix B full scoping report).

The process of identifying inventory needs began prior to the workshop. Each person attending the workshop received a description of each park, inventory status for vertebrates and vascular plants in each park, the goals of the I&M Program, and the objectives of the workshop. During the workshop each group was provided with the most up to date species lists, description of wetlands and a list of museum collections that have been searched for park specimens. During much of the workshop, people were divided up into workgroups according to their expertise. These workgroups included birds, plants, fish, mammals and herps. Each workgroup was given guidelines to help develop plans for inventories. The guidelines were as follows:

1. Review existing inventory data. (Species lists and park bibliographies provided)
2. Identify gaps in inventory data for each park, and then across the parks.
3. Prioritize inventories necessary to fill those gaps identified in step #2.
4. Articulate rationale for prioritization.
5. Describe how these species or habitats will be sampled. What is the best sampling design and effort involved?
6. Provide cost estimates for the surveys you have designed above.

At the end of the day, workgroups presented their suggestions to the entire group. Table 34 shows those suggestions made for the three Coastal and Barrier Network parks.



Table 34. Recommendations for vertebrate and vascular plant inventories for three Coastal and Barrier Network parks, made by taxa experts attending the Virginia scoping workshop, April 3, 2001.

|                | COLO  | THST  | GEWA  |
|----------------|---|---|---|
| <b>Plants</b>  | 75% complete after veg map plots complete? Check on exotics.  | Currently no information, 75% complete after veg map plots complete? RTE needed, Exotics needed | 75% complete after veg map plots complete? Collate previous surveys to enhance to 90%, no RTE needed, check on exotics. |
| <b>Mammals</b> | The group decided that COLO needed further survey work simply because the work that has been done is either outdated or only covered one unit of the park.  | No formal mammalian inventories and very little existing species data.                          | No formal mammalian inventories and very little existing species data.  |
| <b>Birds</b>   | COLO may need baseline where current surveys are non-existent   | Baseline survey needed.   | Baseline survey needed.   |
| <b>Fish</b>    | Confident species list is 90%. Nothing needed immediately. Recommendation- Resurvey in 5-10 years using same methods and gear.                              | Data mine to identify gaps.   | Limited data need baseline inventory.   |
| <b>Herps</b>   | Has 90% for some units, but workgroup prioritized COLO as the most important park to inventory based on #habitat types relevant to amphibians and reptiles. | No data. Needs baseline inventory data.   | Some data, but 10 years old. Need more up-to-date inventory.  |

### *Filling the gaps at COLO, GEWA and THST*

#### *Herps*

To begin filling inventory gaps identified during the scoping workshop, a cooperative agreement with the University of Richmond was amended to include a herpetological inventory at GEWA, THST and the completion of COLO (see section 9 for proposal). Dr. Joe Mitchell, from U Richmond conducted a herp inventory on COLO's Jamestown Island in 2001 and will continue the inventory throughout the rest of the park in 2001-2002 as well as at GEWA and THST.

Dr. Joseph C. Mitchell, has a long history of conducting inventories on amphibians and reptiles in many areas, ecosystems, and habitats. He is a Research Biologist at the University of Richmond. He has published over 200 papers on the ecology and natural history of amphibians and reptiles, as well as three books. His primary field technician is C. Todd Georgel. Todd has worked for Dr. Mitchell for five years on several projects dealing with inventory of amphibians and reptiles on public lands. These include Fort A.P. Hill, three military bases in North Carolina, Shenandoah National Park, and Jamestown Island (part of COLO). He is very experienced in species identification, field techniques, and data collection.

### *Vascular Plants*

A cooperative agreement has been established with the VA Natural Heritage Program, ABI and North Carolina State University to develop vegetation keys and maps for COLO, GEWA and THST (FY01). Once the vegetation plot data is collected and entered into NPSpecies, the database will be evaluated for 90% completeness for each of these parks by a botanist familiar with the parks. Further funding will be sought to fill identified gaps in vascular plant species documentation once these projects are completed.

In 2001, the vegetation classification and mapping project was initiated at THST. Like many eastern units of the National Park Service established primarily for its cultural resources, THST had never had a systematic biological inventory conducted at either the species or community level. The principal investigator for the vegetation classification for this project, Chris Lea, an ASIS employee on loan to the network, is co-authoring, with the Maryland state botanist, a monographic treatment and county atlas of the sedge genus *Carex* (a large and taxonomically complex group of cryptic plants) in Maryland. Because this genus is difficult and poorly understood by even experienced botanists and because of the investigator's knowledge and interest in the group, he offered to document this aspect of the park's flora, in order to supplement future floristic investigations, while planning vegetation classification sampling surveys. In turn, this activity would likely provide some information for the statewide atlas project. While sampling at THST, Chris found and collected a species that did not match known species for the state, even following comparisons with specimens in herbaria. The specimen was then forwarded to Dr. Tony Reznicek (University of Michigan and a Flora of North America (FNA) author for the genus), who recognized it as a species that had not been described, but was the subject of a taxonomic paper in progress by two of his colleagues. Dr. Reznicek delivered the specimen to one of the authors, Dr. Rob Naczi (Delaware State University and another FNA author), who confirmed its identity. Dr. Naczi and his co-author, Dr. Charles Bryson, plan to cite the Thomas Stone NHS specimen as a paratype in their paper, which is expected to be published in early 2002, formally describing and naming this species. (Paratypes are specimens examined by a species author that are supplemental to the holotype ("type specimen") and are often listed in a formal description as representations of a new species across its range and its habitat breadth). Thus, the sedge found at Thomas Stone NHS will contribute to the description of a species new to science and also represent the first known Maryland occurrence of it.

As part of the vegetation mapping effort at THST, the initial plot work, visual inventories and findings described above, have indicated a very high floristic diversity in the park. Experts have recommended a complete floral inventory be conducted even before the vegetation mapping plot data is complete.

### *Mammals*

Because no formal mammalian surveys have been conducted at COLO, GEWA or THST, the mammal workgroup at the scoping workshop suggested complete surveys to be

conducted in these three parks. A full proposal has been submitted to the Network by Dr. Ron Barry from Frostburg University. Funding for this project is being requested in this study plan. (See section 9 for proposal)

### *Birds*

A proposal to inventory birds is being requested from Dr. Bryan Watts of the Center for Conservation Biology, College of William and Mary. As part of a draft environmental impact statement (DEIS) for the redevelopment of Jamestown Island, Dr. Watts just completed a review of COLO's NPSpecies bird list to evaluate what would be expected for the project area. The Association for the Preservation of Virginia Antiquities (APVA) and the National Park Service are collaborating to redevelop Jamestown Island, Virginia in preparation for the 400<sup>th</sup> anniversary, in 2007, of the first permanent English colony in the New World. Redevelopment will include a mixture of new construction, rehabilitation and re-use of structures on Jamestown Island and along the Colonial Parkway. This redevelopment requires the preparation of a draft environmental impact statement (DEIS) as required by the National Environmental Protection Act.

### *Assessing inventory needs for SAHI*

SAHI is currently developing a GMP for the park. Evident by the lack of literature as well as the lack of documented species in the NPSpecies database, SAHI is in need of a number of inventories. The only substantial inventory work done in the park has been on its vascular flora. A vascular plant survey was conducted there in 1997 by the Brooklyn Botanic Garden (BBG) (Dutton, 1997), four visits were made to the site in 1997 and a plant list containing 242 species in 77 families was developed. Vouchers collected during this survey were deposited at the Brooklyn Botanic Garden. As part of this survey, BBG staff reviewed the herbarium at SAHI and those specimens were noted in their report as well. Most of the specimens in the SAHI herbarium were collected in 1995-1996 during a vascular plant survey by Richard Stalter of Rutgers University. The Stalter survey consisted of 232 species in 75 families (Stalter, 2000). Plot data collected for the vegetation map that will be developed for SAHI beginning in 2002, may add additional species to the park's list. Dr. Les Mehrhoff of the University of Connecticut Herbarium is currently reviewing, editing and revising the SAHI NPSpecies plant database. He will determine what percentage of the park's flora has been documented.

Currently there is no vertebrate data in NPSpecies for SAHI. In 1997, a member of the Bard College Field Station conducted a habitat assessment by request of the Eastern Regional Office of the Nature Conservancy (Kiviat, 1997). The purpose of the assessment was to determine if any habitats existed in the park that should be surveyed for rare animal species listed by the New York Natural Heritage Program. A review of the Natural Heritage Program site data in 1996 revealed no existing rare animals on file at that time. A number of survey recommendations were made in this report, including conducting a breeding bird survey in the mature hardwood forests and beach-marsh complex and conducting amphibian and reptile surveys at various wetland sites located on the property.

In order to fill some of the gaps in vertebrate data at SAHI, \$20,000 of regional funds will be used to conduct baseline inventory work in 2002. Allan O'Connell of USGS-Patuxent will conduct a single season mammal inventory at the park. A herpetological inventory is already in progress at SAHI as part of a cooperative agreement with the Wildlife Conservation Society. Field work will be conducted in the park in 2002. Tedi Roosevelt Sanctuary, a local audubon sanctuary, has been contacted to conduct a breeding bird inventory at SAHI, and existing species lists from the adjacent sanctuary itself, will be entered into NPSpecies as "probably present".

## **Section IV-Meeting Park Inventory Needs**

### ***4.1 Summary of Inventory Need***

The following list summarizes the inventory needs of the Coastal and Barrier Network at this time. Park resource managers and taxa experts were consulted and the following projects identified.

**1. Data mining and review to further identify inventory needs:**

Birds-CACO, ASIS, FIIS, GATE, COLO  
Herps-ASIS-scoping meeting with identified experts  
Fish-ASIS, GATE, FIIS  
Marine Mammals-ASIS

**2. General Bird Inventories**

GEWA, THST, COLO (?)

**3. Breeding Bird Inventories in Terrestrial Habitats**

CACO, ASIS

**4. Mammal Inventories**

ASIS, COLO, GEWA, THST

**5. Herpetological Inventories**

COLO, THST, GEWA

**6. Inventories of Specific Herpetological Groups**

GATE, CACO

**7. Plant Inventories**

THST

### ***4.2 Completing the Inventories***

The following list of projects is preliminary, other projects will be identified once existing data has been reviewed by taxa experts.

### **Project 1**

#### **Data mining and review of existing data to further identify inventory needs**

Total \$40,000 (2002 request)

##### *Taxa Experts-BIRDS:*

- COLO-Dr. Bryan Watts, Center for Conservation Biology, College of William and Mary, VA. Dr. Watts has already reviewed some bird data for COLO for Jamestown Island, but he will be consulted on existing data gaps for the park.
- ASIS- Jim McCann, Dave Brinker or Glenn Therres, MD Dept of Natural Resources, MD or Hal Wierenga., Arnold, MD. Funding is requested to hold a scoping workshop for herpetological inventories at ASIS.
- FIIS-Dr. Paul Buckley, USGS-BRD, University of Rhode Island
- GATE-Not identified
- CACO-Robert Cook, CACO Staff

##### *Taxa Experts-FISH:*

**GATE, FIIS**-Expert to be identified

**ASIS**- James Casey, MD Dept of Natural Resources  
Roman Jesian, University of Maryland Eastern Shore  
Al Wesche, MD Dept. of Natural Resources

##### *Taxa Experts-Herps:*

**ASIS**-Joseph Mitchell, University of Richmond  
Scott Smith, MD Dept of Natural Resources  
John Anderson Virginia Museum of Natural History

##### *Taxa Experts-Marine Mammals:*

**ASIS**-To be identified

### **Project 2**

#### **General Bird Inventory-COLO, GEWA, THST**

Estimate \$62,000 (2003-2004 request)

Proposal is being submitted by Dr. Bryan Watts, Center for Conservation Biology, College of William and Mary.

### **Project 3**

#### **Breeding Bird Survey in Terrestrial Habitats –CACO, ASIS**

Estimate \$50,000 (2003 or 2004 request)

RFP's will be written and distributed to potential cooperators.

### **Project 4**

**Mammal Inventory (GEWA, THST, COLO)**

Total \$82,062 (2002 request) See full proposal-Section IX

**Project 4a**

**Mammal Inventory (ASIS)**

Estimate \$50,000 (2003 request)

Identify cooperators

**Project 4b**

**Mammal Inventory (GATE)**

Estimate \$50,000 (2004 request)

Identify cooperators

**Project 5a**

**Herpetological Inventory (GEWA, THST, COLO)**

Total \$49,500 (2002 request) See full proposal-Section IX.

**Project 5b**

**Herpetological Inventory (ASIS)**

Estimate \$50,000 (2004 request) Project will be described following Herp scoping workshop at ASIS.

**Project 6**

**Herpetological Inventory-Distribution and Abundance on Specific Herpetological Groups (CACO)**

Total \$76,000 (2002 request)

The following projects will be included in an amendment to the cooperative agreement established with the Wildlife Conservation Society. Field crews will be working at both CACO and GATE during the 2002 field season and therefore it makes sense economically to include the following work in those projects.

*Inventory amphibian populations at Jamaica Bay Wildlife Refuge (\$15,000)*

As part of a Gateway-wide program of herpetofaunal restoration, individuals of seven species of native amphibians were translocated to Jamaica Bay Wildlife Refuge in the 1980's (Cook 1982, Cook and Pinnock 1986, Cook and Tanacredi 1990). While initial

results demonstrated survival and reproduction in some species, the status of others is unknown (Cook and Zuzworsky 2000).

This project would employ anuran call counts, egg-mass counts, terrestrial drift fences, and coverboards to inventory the amphibian community at JBWR. Data on location and extent of breeding activity, population levels, and reproductive success would be collected. These data would provide an up to date inventory of species present and their abundance, as well as a critical evaluation of the persistence and success of the restoration work conducted in the 1980's.

*Inventory Fowler's Toad and hognose snake, Breezy Point District (\$6,000)*

As part of a Gateway-wide program of herpetofaunal restoration (Cook 1989, Cook and Zuzworsky 2000), eastern hognose snakes were translocated to the Breezy Point District of the Jamaica Bay Unit in the late 1980's. While initial results were successful, coastal storms in the mid 1990's inundated most of the ponds used for breeding by Fowler's toad, the primary prey species of hognose snakes at Gateway. Since these flooding events altered wetland salinity, the abundance of both Fowler's toad and hognose snake in the Breezy Point District appears to have declined.

This project would conduct an intensive inventory of these two species and their habitat in the Breezy Point district. Potential Fowler's Toad breeding ponds would be identified and mapped, salinity and conductivity measured, and hydroperiod monitored. Anuran call counts, minnow traps, net sweeps, and time constrained search will be used to document occurrence and distribution of Fowler's Toad breeding and breeding success. Hognose snakes will be inventoried via coverboards, time constrained search and incidental capture and marked with PIT Tags. In addition to population estimates and local distribution, data on size, weight, and age will be used to determine the viability and condition of the hognose snake population.

*Cape Cod National Seashore-Inventory Spadefoot Toad Breeding Ponds (\$20,000)*

Spadefoot toad is a MA State Threatened Species for which Cape Cod National Seashore provides what appears to be the most significant site in Massachusetts. While their occurrence is well documented, primarily via road cruising, the actual breeding sites remain largely undocumented.

This project would identify, map, and characterize potential spadefoot breeding sites and employ call counts, minnow traps, and dipnetting to identify use by spadefoot toads.

*Cape Cod National Seashore-Inventory Four-Toed Salamanders Breeding Ponds (\$15,000)*

The Four-toed salamander (Hemidactylium scutatum) is a Massachusetts Species of Concern that breeds in sphagnaceous-dominated temporary wetlands. While the occurrence

of this species at CACO has been documented by a handful of records obtained primarily via nighttime road cruising, little is known of their breeding ponds.

This project would identify, map, and characterize potential Four-toed salamander breeding ponds, and employ coverboards, minnow traps, and time constrained search to identify ponds used by this species.

*Cape Cod National Seashore-Inventory Diamondback Terrapin populations and habitat use (\$20,000).*

The northern diamondback terrapin is a Massachusetts Threatened Species that reaches its northernmost limits at CACO, in Wellfleet Bay. While preliminary work has documented important nesting habitats (Shiple and Prescott 1989) accurate estimates of population size and knowledge of habitat use and distribution of animals within Wellfleet Bay are lacking.

This project would partner with Massachusetts Audubon Society to provide mark/recapture estimates of population size, and employ radio-tracking/sonic-tagging to document habitat use by this species.

## **Project 7**

### **Plant Inventory (THST)**

Total \$8,000 (2002 request)

Project Description: Brent Steury, NCPE Botanist will complete a floristic inventory at THST by visiting the site several times over the growing season. His first visit was in September-October.

## **Section V-Product Specifications**

Product specifications are being developed for the Northeast Region I&M Program. The following is a list of deliverables that will be required of all cooperators and contractors working in the Coastal and Barrier Network as part of the I&M Program. Research taking place in the parks, independent of the funding source, will also be required to provide these products at the end of each project.

### *1. Species Data*

#### *Raw Data*

Copies of all raw data, such as hand written field forms (if used), must be provided if requested by the Network.

#### *Species Inventory Database*

All inventory data will be provided in an MS Access database. Database templates being developed by WASO for inventory and monitoring data will be required and used by the Network.



## 2. GPS Data

Cooperators must provide GPS coordinates and attributes (e.g. location ID, description, and habitat classification) for all fixed sampling locations (e.g. plots, transects, etc...). Cooperators are also encouraged to obtain GPS coordinates and attributes for observations obtained from general search areas or opportunistic sightings, but are not required to do so. GPS data must be differentially corrected with base station files. The data should be supplied as an ArcInfo coverage or as an ArcView shapefile in the coordinate system currently in use at the park. For most parks, this will be the correct UTM zone in which the park is found. The datum should be the North American Datum of 1983 (NAD83); the ellipsoid should be the Geodetic Reference System 80 (GRS80); and units of measure should be meters.

## 3. Metadata

### *Non-spatial digital data*

Metadata must be provided in NPS Dataset Catalog format for each non-spatial digital data set produced.

### *Spatial digital data*

Cooperators must provide metadata for each spatial digital data set (e.g. GPS coverage of fixed sampling locations) produced. All metadata must follow Federal Geographic Data Committee (FGDC) compliance standards.

## 4. Voucher Specimens

The Coastal and Barrier Network chooses to leave the issue of vouchering up to the discretion of the park where the inventory is taking place. An agreement on vouchering must be reached prior to beginning the inventory.

## 5. Reports

### *Progress Reports*

Progress reports must be submitted digitally in Word format, and as paper copy if requested. Minimally, they will be due annually dependent upon the length and scope of the project.

### *Final Reports*

The final report will be submitted digitally as draft in MS Word, and as paper copy, to the Regional I&M or Network Coordinator for management and scientific review and comment. It must include methodology, analysis, results and discussion. The final report will be submitted in digital and paper copy formats. Because the final report will be made available on an NPS website, it must be submitted both as 1) a Word 6.0 or higher version document (.doc) in its entirety on diskette or CD-ROM, and 2) a Word 6.0 or higher version document (.doc) containing all text and tables, and individual Tiff documents (.tif) for each graphic image contained in the report on that same diskette or CD-ROM.

### **5.1 Voucher Specimen Collection**

A repository for specimens collected during inventory work in the Coastal and Barrier Network parks has not yet been identified. At this time, any specimens collected will be

housed at the cooperating University or associated institution. The final decision on the collection of voucher specimens will be left up to the discretion of each park, but the collections policy for the Northeast Region I&M Program is as follows. **Cooperators may collect whole specimen vouchers** on amphibians, snakes, mammals, fish and plants **only if**:

1. **Identification of a species is in question.** Certain taxa such as fish may require more intensive vouchering than other taxa such as mammals.
2. **Or if a particular species has not yet been collected in a park.** A list of existing voucher specimens will be available for each park, and cooperators are required to review this list prior to fieldwork.

Plants and animals that **may not** be whole-specimen vouchered include birds, turtles, large mammals and common plant species. If vouchering is necessary for identification purposes, then photo documentation is required.

### **Photo Documentation**

The Coastal and Barrier Network is requiring all cooperators to use non-invasive methods of vouchering, such as hardcopy color photography, high quality digital photography or animal signs or remains (e.g. hair samples, scat or tracks) whenever possible. Photographs of a species will be considered a voucher and will be referenced in NPSpecies. Photographs taken to provide documentation of a species must be taken with a macro or close-up lens. Photographs should show known features used for identification of a species. It may be necessary to take more than one photograph of an individual from different angles. All photographs must be submitted with the pertinent raw data. All slides and photographs must be kept in appropriate protective sleeves.

### **Whole Specimens**

Collectors will be responsible for cataloging specimen/field notes for items deposited into non-NPS repositories. The more information a collector can provide, the more useful the specimen/field notes will be to future managers and researchers.

Voucher preparation will be the responsibility of the cooperator who must have a valid park permit to collect specimens. All vouchers taken on NPS lands, regardless of their repository, will be the property of the NPS. Cooperators will be responsible for accessioning voucher specimens into ANCS+.

Voucher specimen collection must follow the guidelines defined by the Components of British Columbia's Biodiversity (CBCB) manual #4, Collection and Preparation of Voucher Specimens and any guidelines a cooperating institution's Animal, Care and Use Committee has developed.

### ***Mammalian Collection***

In order to minimize disturbance on mammalian populations in the parks, photo vouchering and collecting animals where death resulted from either trap mortality or road kill will be priority over euthanizing individuals. Vouchering methods are described in Table 35 for some mammalian groups that may be found in northeastern parks. Guidelines found in the *Live Animal Capture and Handling Guidelines*, manual no.3, will be followed for proper capture, handling and euthanasia procedures. Guidelines and references for the preservation of voucher specimens can be found in *Measuring and Monitoring Biological Diversity, Standard Methods for Mammals* (Wilson et. al, 1996).

Table 35. Vouchering methods for some mammalian groups.

| <b>Taxa</b>   | <b>Vouchering Method</b>   |
|---|--|
| Bats  | Wing punch or whole specimens for easily misidentified species when capture is part of the inventory protocol. Morphometric data, photographs, digital sonograms or cassette tapes with reference calls should also be collected as evidence of rare or endangered bats. |
| Small Mammals - Shrews, Voles, Mice, Rats and Lemming | Three of each species: 1 of each sex (if sexes are distinguishable) and the 3rd a juvenile (of either sex) is preferred, especially if there is much difference from the adults.   |
| Moles   | Whole specimens only if trap mortality occurs.   |
| Medium-sized mammals                                  | Photo vouchers or specimen voucher from trap mortality and road kill, collection of other sign when possible (tracks, hair, scat).   |
| Large mammals   | Photo vouchers, collection of other sign when possible (tracks, hair, scat)  |

### ***Fish Collection***

Digital photographs can be an accurate and economical method for vouchering fish specimens. The Network will follow the guidelines for vouchering fish specimens by Dr. Jay Stauffer and Timothy Stecko from Penn State University (Guidelines are available from the Northeast Regional Coordinator). Although it may not be possible to identify all fish specimens from digital photographs taken in the field, these guidelines will be useful for most fish collected. Immature fishes of all species and some of the minnow species, particularly in the genus *Notropis*, need to be collected and properly preserved.

### ***Amphibian and Reptile Collection***

For identification purposes, most species of amphibians and reptiles can be adequately confirmed from photographs. Collecting whole specimens of amphibians and snakes will only be allowed as stated above, if a whole specimen does not exist for a park. Turtles must be photo documented only.

### ***Vascular Plant Collection***

Species that are common to the park or have already been vouchered should not be collected. Because any collection of specimens impacts a population, it is especially important when collecting rare species to weigh the destructiveness of collection against the amount of information gained. Federal and state Threatened and Endangered plants will not be collected in populations of less than 50 individuals (Elzinga et. al, 1998). It is incumbent upon the cooperator to know which taxa are locally or nationally rare or protected, and to be familiar with all federal and state legal procedures for collecting. In small populations, only small portions of plants will be collected if necessary.

Cooperators are advised not collect indiscriminately, even in large populations, and to collect only the minimum amount of plant material necessary. (The Plant Conservation Round Table, 1986).

Voucher specimens will be collected during inventory in accordance with collections policies outlined in *NPS Management Policies* ("Museum Objects and Library Materials" and "Preservation of Data and Collections and Protection of Research Potential") and NPS-77, *Natural Resource Management Guideline*. Obtaining the necessary permits for collecting will be the responsibility of the cooperator/contractor and the parks.

For all voucher specimens, cooperators will be asked to fill in the information below and submit information as an Appendix with their final report. This information will enable the park to fully document their research in the National Park Service's National Catalog as well as the NPSpecies database.

### **BIOLOGICAL SPECIMENS:**

- Collection Permit number: \_\_\_\_\_
- Fixative or killing agent used: \_\_\_\_\_
- Preservative agent used: \_\_\_\_\_
- Number of specimens: \_\_\_\_\_
- Order: \_\_\_\_\_, Genus \_\_\_\_\_, Species: \_\_\_\_\_
- UTM, Latitude/ Longitude, or elevation where collected: \_\_\_\_\_
- Collection Site: \_\_\_\_\_
- \_\_\_\_\_
- Principle Investigator: \_\_\_\_\_
- Specimen Identified (classified) by: \_\_\_\_\_
- Collection Date: \_\_\_\_\_

## **5.2 Compliance**

The Coastal and Barrier Network will incorporate compliance with park and regional research and collection policies, the National Historic Preservation Act (NHPA), Section 106, and the National Environmental Policy Act (NEPA) throughout the implementation, and reporting phases of its biological inventories.

Individual parks within the Network have specific permitting requirements that will be outlined in the Statement of Work for each contract. At a minimum, each researcher will be required to obtain a park Collection Permit and must submit an Investigator's Annual Report upon completion of each inventory.

Documentation of study plan approval from the Fish and Wildlife Service (FWS) will be required for those projects with the potential to effect federally listed T&E species.

## **Section VI Data Management**

As the Inventory and Monitoring Program develops and years pass, not only will there be data existing for the nine parks in the Network, but there will be data collected by different biologists, scientists, and technicians, that will consist of unavoidable variation. In order to reduce such variation, and to ensure the reliability and usability of the information gathered, the Coastal and Barrier Network will develop a data management plan that provides sufficient standards for managing such data. An information management system will set the foundation for obtaining consistent end products among studies, and provide for the documentation of all efforts and results in a consistent and comprehensive manner. Sufficient effort must go into the planning and design phase of creating a workable data management plan that will continue to be used throughout the Network's long-term monitoring program. Data management is a high priority for the Network. The Network has and is in the process of converting all of the relevant existing data into NPSpecies and into relational databases as discussed in this plan. A full-time term data manager position will be filled to coordinate and manage both legacy and newly acquired data for the network. This position will work closely with other NPS staff at the network, region and service-wide level to meet the data management goals in the most efficient and cost effective way possible.

There has been a great deal of effort by WASO I&M to develop tools for managing inventory and monitoring data which includes digital, bibliographic and spatial information, and excellent guidance is provided in the data management protocols (NPS 1996). The I&M Database Templates developed by the Servicewide I&M Program will be used to help the Network develop a relational database that is compatible with the GIS Theme Manager. The Coastal and Barrier Network plans to build on these available resources and as discussed in the Heartland Network's Inventory Plan, this Network will emphasize the role of data management in the course of data collection and handling.

The minimum standards that will be required of contractors and cooperators will include:

- Standardized collection and data entry methods
- Software requirements
- Standardized data fields dependent upon the Database Template Data Dictionary
- Data verification and validation requirements
- Metadata requirements

**Network Objectives Include:**

1. Identifying the data backlog for the Network and complete the entry of this material into the appropriate databases, NPSpecies database, the Dataset Catalog, NRBIB or GIS.
2. Provide a data management framework and methodology for current field collections, which will include protocols for both spatial and nonspatial data collection and handling.
3. Ensure FGDC compliant metadata for all information.
4. Identify partnerships and common strategies for data collection and management.

***6.1 Data Collection***

The Coastal and Barrier Network will require the use of standardized field forms that contain standardized locations and events codes as well as habitat measures for all inventory and monitoring projects. Field activities are to be well documented by requiring all investigators to document their standard operating procedures used during the course of their study. This will include a step-by-step description of the procedures used to collect data, including any modifications or adjustments made to accommodate field conditions, the precision of instruments, etc... All raw data collected during the biological inventories, as well as all summary products produced will be entered and/or cataloged into the appropriate service-wide product on an annual basis.

***6.2 Data Verification***

All principle investigators are expected to verify their data 100% before submitting it to the Network. The Network will require copies of all field data sheets from cooperators and sub-samples of the data will be compared with the associated field data sheets. A minimum of 95% accuracy will be expected.

***6.3 Data Formats***

***Non-Spatial Data***

All non-spatial inventory data must be submitted to the Network in MS Access database format. The Network Data Manager will begin developing a relational database for the Network that will be based on the NPS I&M Database Template being developed by

WASO. The Network database will be provided to all investigators along with standardized field forms, before field work begins. The NPS I&M Database Template will be the final product for newly acquired data from field surveys to facilitate it's linking to the GIS Theme Manager.

### **GIS Data**

Spatial data, which include GPS generated files, must conform to the following guidelines:

#### *Projection and Coordinate System*

All digital geospatial data should reference the coordinate system corresponding to the standard presently in use at the park which, for most parks, will be the correct UTM zone in which the park is found. The datum should be the North American Datum of 1983 (NAD83); the ellipsoid should be the Geodetic Reference System 80 (GRS80); and the units of measure should be meters. The contractor should contact the park's GIS Coordinator for specific instructions and/or refer to the contract or cooperative agreement.

#### *Scale and Spatial Resolution (Vector Data)*

New data should not exceed 1:24,000. The contractor should contact the park's GIS Coordinator for specific scale and spatial resolution requirements for vector data or they may be specified in the contract or cooperative agreement.

#### *Scale and Spatial Resolution (Image Data-digital or aerial photography)*

The contractor should contact the park's GIS Coordinator for specific scale and spatial resolution requirements for image data or they may be specified in the contract or cooperative agreement.

For vegetation classification under the NPS/USGS vegetation classification project, the current standard is 1:12,000 color infrared aerial photographs with 60% overlap and 30% sidelap.

#### *Horizontal and Vertical Accuracy*

All data should meet or exceed the following National Map Accuracy standards (Source: USGS Fact Sheet 078-96, September 1997).

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For maps on publication scales larger than 1:20,000, not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50 inch. These limits of accuracy shall apply to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as benchmarks, property boundary

monuments; intersections of roads and railroads; corners of large buildings or structures (or center points of small buildings). In general, what is well-defined will also be determined by what is plottable on the scale of the map within 1/100 inch. Thus, while the intersection of two roads or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be scaled closely upon the map. This class would cover timber lines and soil boundaries.

Vertical accuracy, as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error by more than one-half the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

The following table provides the allowable horizontal accuracy for some common scales:

| <u>Scale</u> | <u>Allowable error (feet)</u> |
|--------------|-------------------------------|
| 1:40,000     | 111                           |
| 1:24,000     | 40                            |
| 1:20,000     | 33                            |
| 1:12,000     | 20                            |
| 1:9,600      | 16                            |
| 1:4,800      | 8                             |
| 1:2,400      | 4                             |
| 1:1,200      | 2                             |

#### *Attribute Accuracy*

At a minimum, an 80% or greater overall thematic attribute accuracy at the 90% confidence interval is required. The contractor should contact the park's GIS Coordinator for specific attribute accuracy requirements or they may be specified in the contract or cooperative agreement.

#### *Spatial Data Formats*

At a minimum, all vector data is to be supplied as an ArcInfo coverage and ArcInfo interchange file, e00, compatible with the current version of ArcInfo for the MS Windows operating system. All raster data is to be supplied as an ArcInfo GRID and ArcInfo interchange file, compatible with the current version of ArcInfo for the MS Windows operating system. All digital imagery, such as scanned aerial photographs, is to be supplied as tagged image file format (tiff) files with the proper header file for geo-



referencing purposes. The contractor should contact the park's GIS Coordinator for specific data formats or they may be specified in the contract or cooperative agreement. All data should be delivered on CD ROMs compatible with the MS Windows operating system.

### *Quality Control*

When the contractor has completed 10% of the spatial and attribute data development, the contractor must supply the data to the park and appropriate Regional Technical Support Center (RTSC) for quality control purposes. The data must be delivered in conformance to the Spatial Data Formats requirements. Once the park and RTSC have checked the data and found it acceptable, the contractor may continue data development. Once the contractor has completed the work, the park and RTSC must accept the spatial data, attribute data, and Federal Geographic Data Committee (FGDC) compliant metadata before the job is considered complete.

Results of tests used to verify all applicable horizontal, vertical and attribute accuracy measurements should also be provided whenever data is provided to the park and RTSC.

### ***6.4 Metadata***

All digital geospatial data must have FGDC compliant metadata in digital form developed by the data producer. The metadata should be parsed using the metadata parser provided by the FDGC (<http://www.fgdc.gov>). The metadata should be supplied as ASCII text with a txt extension, hypertext markup language with an html extension and standard general markup language with an sgml extension. The contractor should contact the park's GIS Coordinator or the appropriate RTSC for metadata development instructions.

All digital non-spatial data must be provided to the Network with a digitally completed Dataset Catalog form.

### ***6.5 Data Cataloging***

All products cataloged into the NPS service-wide NRBib or Dataset Catalog databases will be archived for future acquisition. Hardcopy products will be stored in file cabinets, shelves or other appropriate structures. Digital products will be copied to CD-ROM and appropriately stored as well. The exact local of archived products has yet to be determined and may occur at the park, network, region (or support office), and/or service-wide level. The copies will be appropriately organized to facilitate future acquisition. Each entry in NRBib or the Dataset Catalog will include the physical location of each product. Conversely, each stored product will be marked with the unique identifying code assigned in the database. On an annual basis, at a minimum, final MS Access files will be stored on CD-ROM, copied, and stored in separate locals. The copies will be appropriately organized to facilitate future acquisition. An entry will be made in the NPS Dataset Catalog for each database file (or files) that includes the physical storage location

of the CD. The Dataset Catalog Identification code (or codes if multiple files are stored on one CD) will be marked on each stored copy.

## **Section VII-Staffing and Support**

### ***7.1 Staffing***

#### ***I&M Program Support***

The Northeast Region I&M Coordinator will provide technical assistance with contracting and cooperative agreements for the Coastal and Barrier Network. She will oversee and assist the Network and provide guidance in completing the inventory initiative in these parks.

The Coastal and Barrier Network Data Manager will develop a data management plan for the network to assist parks with the management of legacy and inventory and monitoring data.

A Coastal and Barrier Network Coordinator will be hired early 2002 to assist with inventory and monitoring planning.

#### ***Park Staff***

Chris Lea-ASIS- Agreement signed with ASIS to detail Chris Lea, ASIS plant ecologist to the network for ½ year. He will review plant data for GATE, FIIS and SAHI to determine the need for additional floristic inventories.

Robert Cook-CACO-Bob will review bird, mammal and herp lists in NPSpecies for GATE and CACO.

### ***7.2 Partnerships***

#### **University of Rhode Island-Cooperative Agreement**

- Data Management Support
- I&M Program Regional Coordinator (duty station)
- Coastal and Barrier Network Data Manager (duty station)
- Research Associate-NPSpecies

#### **Penn State University-Cooperative Agreement**

- NRBIB Specialist-Research Associate
- Collections Search for Fish Specimens-Dr. Jay Stauffer (NY, NJ, PA, VA, WV, MD)
- NPSpecies-Research Associate

#### **Frostburg University CESU -Cooperative Agreement**

- Mammal Inventory-Dr. Ron Barry (COLO, THST, GEWA)

#### **University of Richmond -Cooperative Agreement**

- Herpetological Inventory -Dr. Joseph Mitchell (COLO, THST, GEWA)

**College of William and Mary-Cooperative Agreement**

- Avian Inventories-Dr. Bryan Watts (COLO, THST, GEWA)

**VA Natural Heritage Program-Cooperative Agreement**

- Vegetation Mapping Plot Data/vascular plant inventory –Chris Ludwig (COLO, GEWA)

**North Carolina State University-Cooperative Agreement**

- Vegetation Mapping–Dr. Hugh Devine (COLO, GEWA, THST)
- Dataset Catalog

**The Association for Biodiversity Information-Cooperative Agreement**

- Development of vegetation keys to the association level: tools to facilitate vegetation mapping, inventories and sampling-Lesley Sneddon (All Coastal and Barrier Network Parks).

**USGS-Patuxent Wildlife Research Center**

- Voucher Specimen search-Dr. Allan O’Connell. Vertebrate (non-fish) and vascular plant vouchers
- Allan O’Connell will complete a mammal reconnaissance at SAHI

**Wildlife Conservation Society**

- Herpetological inventories (GATE, SAHI, CACO, FIIS)

**University of Massachusetts**

- Freshwater fish inventory (CACO)

**University of Connecticut**

- NPSpecies plant database review (SAHI, FIIS, GATE)

## Section VIII-Inventory Plan Budget

### *Northeast Coastal and Barrier Network Pre-proposal Funding*

Table 36. Projects funded through the Northeast Coastal and Barrier Network I&M Program funds requested in the pre-proposal (FY00-\$122,000).

| <b>Projects</b>  | <b><i>FY 00</i></b> | <b>Cooperator</b>   |
|--|---------------------|---|
| Update NRBIB   | \$11,250            | Penn State-Scott Tiffney (Cost share with 4 networks)               |
| NPSpecies (Research associate)                                 | \$17,153            | Penn State University (PSU)<br>(cost share with 3 networks)         |
| Northeast Region I&M Program Assistant<br>(Research Associate) | \$10,690            | University of Rhode Island<br>(Cost share with 4 networks)          |
| Dataset Catalog development                                    | \$31,158<br>\$2,000 | University of Rhode Island (URI)<br>North Carolina State (NC State) |
| Travel   | \$4,549             |   |
| Equipment (computer)   | \$5,200             |   |
| <b>Total</b>   | <b>\$82,000</b>     |   |
| Funds remaining  | \$40,000            | Put toward other projects and repaid in 2001                        |

Table 37. Northeast Coastal and Barrier Network inventory projects funded through remaining FY00 funds.

| <b>Projects</b>                                | <b><i>FY 01</i></b> | <b>Cooperator</b>  |
|--|---------------------|--|
| Herpetological Inventories<br>(GEWA,THST,COLO) | \$40,000            | U. of Richmond, Joe Mitchell (the total project<br>cost=\$49,500, additional funds requested FY02) |
| <b>Total</b>                                   | <b>\$40,000</b>     |  |

The following inventory projects were funded through Network monitoring funds in FY01. This funding is being requested from Network Inventory Funds for FY02 to reimburse the Network's monitoring account.

Table 38. Northeast Coastal and Barrier Network inventory projects funded in FY01 via Network monitoring funds.

| Budget Item  | FY02             |
|--|------------------|
| <b>Inventory Projects Funded in FY01 via Network Monitoring Funds</b>                              |                  |
| Catalog ASIS herbarium (ANCS+)   | \$5,319          |
| Herp inventories (GEWA, THST, COLO)- project \$49,500, \$40,000 inventory funds were used in FY01. | \$9,500          |
| Mammal Inventories (GEWA, THST, COLO)  | \$82,062         |
| General Herp inventory (GATE)  | \$10,876         |
| <b>Total</b>   | <b>\$107,757</b> |

The total funds to be allocated to the Network for vertebrate and vascular plant inventories is \$866,885, \$122,000 of this was provided to the Network in FY00. The following table provides only a preliminary list of inventory projects for the Coastal and Barrier Network. Further projects will be identified by taxa experts once all existing data has been compiled and reviewed.

Table 39. Northeast Coastal and Barrier Network Inventory Plan Budget.

| Budget Item  | FY02             | FY03              | FY04              | FY05            |
|--|------------------|-------------------|-------------------|-----------------|
| <b>Inventory Projects Identified for FY02</b>                  |                  |                   |                   |                 |
| Data mining and review by taxa experts                         | \$40,000         |                   |                   |                 |
| Herp Scoping Workshop (ASIS)                                   | \$4,000          |                   |                   |                 |
| Herp Inventories-Targeted species (CACO, GATE)                 | \$76,000         |                   |                   |                 |
| Floristic Inventory (THST)                                     | \$8,000          |                   |                   |                 |
| <b>Total Inventory Funds Requested FY02</b>                    | <b>\$137,500</b> |                   |                   |                 |
| <b>Inventory Projects Funds to be requested FY03-05</b>        |                  |                   |                   |                 |
| Terrestrial Mammal Inventory (ASIS) to include bats            |                  | \$50,000*         |                   |                 |
| Terrestrial Mammal Inventory (GATE)                            |                  |                   | \$50,000*         |                 |
| Bird Inventories (GEWA, THST, COLO)                            |                  | \$62,000*         |                   |                 |
| Terrestrial Breeding Bird Inventory-ASIS                       |                  | \$25,000*         |                   |                 |
| Terrestrial Breeding Bird Inventory-CACO                       |                  | \$25,000*         |                   |                 |
| Herp Inventory-ASIS  |                  |                   | \$50,000*         |                 |
| Additional projects identified after data review               |                  | \$79,000*         | \$79,000*         | \$79,628*       |
| <b>Funds requested to return to Network Monitoring Account</b> | <b>\$107,757</b> |                   |                   |                 |
| <b>Total funds requested</b>                                   | <b>\$245,257</b> | <b>\$241,000*</b> | <b>\$179,000*</b> | <b>\$79,628</b> |

\* Estimates

## Section IX Proposals

### *9.1 Mammal Inventory (GEWA, THST, COLO)*

Proposal to Conduct Mammal Surveys in, George Washington Birthplace National Monument, Thomas Stone National Historic Site, and Colonial National Historical Park

Ronald E. Barry  
Department of Biology  
Frostburg State University  
Frostburg, MD 21532-1099

#### **Overview**

The National Park Service (NPS) has identified the need for surveys of mammals in three coastal national parks in the Northeast Region. Acquiring such natural resource information is in compliance with the Vail Agenda mandate to the NPS's Natural Resource Inventory and Monitoring Program (NPS 1998). One of the five long-term goals established by this program is to complete baseline inventories of basic biological and geophysical natural resources for the national parks. During Phase I of the natural resource inventory the NPS has set an objective of documenting the presence of at least 80% of all plant and animal species (excluding invertebrates) occurring within a park's boundaries; the stated objective for the mammal survey of the parks of the Northeast Region is 90%. Surveys will confirm the existence of currently listed species and document the presence of new ones. The data collected provide important baseline information that can be used by natural resource specialists in monitoring programs to note changes and quantify trends in resources and relate variation in time to potential causes. Such monitoring programs can result in management decisions that effect proper stewardship of the park system by NPS.

I propose to conduct surveys of mammals in 3 coastal parks: George Washington Birthplace National Monument (GEWA), Thomas Stone National Historic Site (THST), and Colonial National Historical Park (COLO). GEWA consists of 551 acres (223 ha) on the coastal plain east of Fredericksburg, Virginia, in Westmoreland County. The monument was authorized in 1930 and opened under the administration of the NPS in 1932. It consists chiefly of open grasslands and forests, with 25 acres of marshes and estuaries. THST consists of 297 acres (120 ha) in Charles County, Maryland, approximately 4 miles west of La Plata and 25 miles south of Washington, D.C. The park opened in 1992 and is comprised largely of forests and open fields. COLO encompasses approximately 9,327 acres (3,776 ha). It is located in southern, coastal tidewater Virginia and is composed of Jamestown Island, Yorktown Battlefield, and the 23-mile (38-km) Colonial Parkway that connects the island and battlefield. More than one-half of the area consists of forest. Over 30% is floodplain; wetlands (including forested) and managed fields constitute much of the park. COLO contains 30 miles (49 km) of shoreline along the James and York rivers, 24 miles (39 km) of perennial streams, and 30 miles (49 km) of intermittent streams and drainage's.

The NPFauna (2001) database lists records of 22 species of mammals (orders Marsupialia, Insectivora, Chiroptera [2 species], Rodentia, Lagomorpha, Artiodactyla and Carnivora) in the GEWA. The database lists 0 records of mammals for the THST and 26 species (orders Insectivora, Chiroptera [3 species], Rodentia, Artiodactyla, and Carnivora) for the COLO.

## Project Description

### *Goal*

The primary goal of the proposed project is to survey the mammals (excluding bats) of GEWA, THST and COLO with the purpose of documenting  $\geq 90\%$  of the species that occupy each of these parks and describing the relative abundance of species of concern. A secondary goal associated with graduate student thesis projects is to provide information on mammal communities of the parks.

### *Objectives*

#### Primary

1. Review all natural resource studies that have occurred within the parks' boundaries and all historical scientific material stored in the parks to develop a database of mammal species (excluding bats) that possibly occur in the parks.
2. Conduct extensive surveys of the parks for, and catalog, the presence, distribution, and relative abundance (for species of concern) of mammal species in forests, grasslands, agricultural fields, riparian areas, marshes, rock outcrops, etc. at GEWA, THST and COLO.

#### Secondary (graduate student theses)

1. Describe habitat-specific species diversity in the 3 parks.
2. Assess the status of mammals within each of the parks and provide recommendations for monitoring mammal populations.

### *Methods*

Historical records.-Initially we will establish an electronic database (Microsoft Access 2000) of records of mammal species for each of the 3 parks from existing databases such as NPFauna (2001), park records, records of museums such as the U.S. National Museum (Smithsonian), university/college and local collections and museums, and published literature. The database should be compatible with that of other national park units and NPFauna (2001) so that information can be used at the ecosystem and landscape levels (NPS 1998). The database will contain at least the complete taxonomy (Wilson and Reeder 1993; Jones et al. 1997) and common name of each species, location (park) of each species, and source of the record.

Delineation of habitats.-The recognition of major habitat types will allow stratification of the sampling effort in the 3 parks. This will ensure a representative and comprehensive survey of the small mammal fauna by increasing the efficiency with which individual species are detected, particularly those that are rare. Habitats will be identified by GIS cover maps, if available, or aerial photos. Topographic maps will be important in identifying habitat potentially important to (or avoided by) certain species. Major habitat types should include, but not be limited to, forests (deciduous, coniferous, mixed, and wetland), grasslands, agricultural fields, rock outcrops, riparian zones, and marshes. In addition, recognizable corridors (of various habitat types) will be identified and sampled. Strata will be ground-truthed before final selection of sampling sites. Because habitat changes over time, permanent boundaries of original strata will be delineated on GIS maps to permit long-term monitoring of animal populations and vegetation (NPS 2000).

Sampling protocol.-Sampling sites will be located within well-defined habitat types (see above) to permit stratified sampling for developing a representative list of species and an efficient means for monitoring and managing populations. In addition, unusual or less common or expansive habitats (e.g., bogs) will be sampled because they often harbor small populations or rare species important in monitoring the health of an ecosystem or landscape. The number of sampling locations (sample units) within any single park will be dependent on the number, size and distribution of habitat types and constraints imposed by accessibility, equipment and personnel. Historical records and site visits to a park, once habitats are defined, will be factors in determining the number of sampling locations. Sampling on private property will occur only with the permission of the landowner.

To identify sampling points, systematic grids will be superimposed on park maps that depict habitat types (NPS 2000). Points on a grid, within a habitat type, will be selected without replacement by the generation of random numbers (either computer-generated or from a random numbers table) representing grid cells (Rudran and Foster 1996). Edge areas (habitat edge, roads, etc.) known to influence species richness and abundance of mammals (e.g., Cummings and Vessey 1994), portions of parks frequented by the public, and areas inaccessible to ground personnel will be removed from consideration as sampling locations. Once selected on a map, a sampling location will be located in real space using differentially corrected GPS. Before sampling begins, a review of sampling locations and times will be solicited from park management.

Sampling will rely on capture of small mammals using primarily Sherman and Tomahawk live traps (for larger shrews, mice and voles, squirrels, etc.) and pitfall trap arrays (for shrews and small mammals < 10 g -- Kirkland and Sheppard 1994). Traps will be arrayed at sampling points in randomly positioned linear transects or grids, with the number of traps and trap spacing dependent on habitat type and patch size (Jones et al. 1996). The trapping effort needed to account for  $\geq 90\%$  of all species within each habitat will be determined by a species accumulation curve; once a plateau (asymptote) is reached, sampling will cease, at least for that sampling period. This sampling regime will permit a measure of species richness and relative abundance for each park. Locations for sampling small mammals will generate observations and signs of larger mammals; species, location and date for each such mammalian encounter will be recorded on data sheets for inclusion in the database for the park. Tomahawk traps used for capturing larger mammals for species identification will be placed in locations where sign is detected or where habitat features suggest the presence of these species. Remote cameras will be used to document the presence of large, secretive and elusive species.

Habitat at each sampling location will be characterized by such features [at randomly selected sites] as dominant vegetation, percent canopy cover, abundance of shrub and ground cover, degree of disturbance (e.g., primary or secondary forest or plantation, agricultural use of grassland, frequency of fire or flooding), substrate and soil type, presence of rock piles, topography and elevation (Barry et al. 1999; Boyce 2001; McDiarmid and Wilson 1996). Temperature and precipitation for sampling dates will be obtained from the park weather station or the nearest available weather station if none exists within the park.

Captured individuals of small species (those in Sherman and pitfall traps) will be removed from traps (Jones et al. 1996), identified to species, weighed using a Pesola scale, and examined for age, sex, and reproductive condition. Individuals captured in Tomahawk traps will be identified to species, and, if practical, weighed using a Pesola scale and examined for age, sex and reproductive condition. Because recognition of individuals is necessary for determining relative abundances (NPS priority for species of concern) and measures of species diversity (graduate student theses projects), captured individuals may be marked by spot-shaving, hair-dyeing, ear-tagging (Monel #1 tags, National Band and Tag Co., Newport, Kentucky) or toe-clipping, (ASM 1998; Rudran 1996). Release will be immediate at the capture location. Live-trapping and handling procedures will



be administered humanely (Rudran and Kunz 1996) and be consistent with the animal handling guidelines of the American Society of Mammalogists (ASM 1998). Also, proper precautions will be taken by investigators to prevent human injury and exposure to disease, especially rabies, Lyme disease, hantaviral pulmonary syndrome (HPS), and human ehrlichiosis (Gage et al. 1995; Kunz et al. 1996; Mills et al. 1995).

Compilation and analysis of data.-Data on habitat and all mammals captured or observed (including sign) will be stored in an electronic database (Microsoft Access; see **Deliverables** below). These data will be combined with historical data to determine the number of species in a park. Current data will be used to determine distribution and habitat of species. Associations of species with habitat type and variables, and determination of relative abundance, will rely on such customary statistical procedures as regression, ANOVA, chi-square, and log-likelihood analyses (Zar 1999). Estimates of species diversity, richness and evenness for graduate student thesis projects will derive from customary models (e.g., Shannon-Wiener index, rarefaction, and Pielou's J' – Krebs 1999) to facilitate comparisons among habitats, parks and investigators and at various sample sizes. Statistical analysis will be conducted at Frostburg State University (FSU). The final report will include, for each park, records of all mammal species and their distributions, relative abundances of species of concern, survey methods and weather conditions, locations of voucher specimens, and recommendations for long-term monitoring for use by park management.

### **Project Coordination**

Project personnel will include the project director (cooperator) and 3 graduate student investigators, one assigned to GEWA/THST and the other two to COLO. The project director will oversee all activities. Park staff will be notified beforehand by phone or e-mail of all project activities to be undertaken in the park. Monthly schedules, developed in coordination with park management, will be produced by project investigators. Schedules will be adhered to as closely as possible but be subject to change due to weather or unforeseen personnel circumstances; changes in schedule will be communicated in advance by project investigators. The project director will obtain park permits and a state scientific research and collecting permit for conducting the research, collecting specimens, and depositing specimens in the mammal collection at Frostburg State University; investigators (subpermittees) will carry copies of the permits during sampling. In addition, the project director will obtain approval from the Institutional Review Board/Animal Care and Use Committee at Frostburg State University to conduct the research. Where park housing is available, project investigators may submit requests for overnight stays when this is necessary for survey work. The project director will negotiate with park management and natural resource personnel any use of park equipment (e.g., GPS) that can facilitate data collection and contribute to the successful completion of the project.

### **Deliverables**

#### *Project description*

The complete description of the project will be submitted by 31 August 2001.

#### *Species data*

Field forms will be provided, upon request, to the NPS I & M Program.

Digital data sets will be produced in Microsoft Access format, using the NPS I & M template ([www1.nature.nps.gov/im/apps/template/](http://www1.nature.nps.gov/im/apps/template/)) or one specifically developed for the particular project.

### *GPS data*

GPS coordinates, differentially corrected, will be provided in ArcInfo format or as an ArcView file for all sampling locations and observation sites.

### *Metadata*

Metadata will be provided in Dataset Catalog format (nonspatial data) or, with the cooperation of NPS data managers, in Federal Geographic Data Committee (FGDC) format (spatial data) found at [www.fgdc.gov/metadata/metadata.html](http://www.fgdc.gov/metadata/metadata.html).

### *Voucher specimens*

The mammal collection of the Department of Biology at Frostburg State University will be the repository of voucher specimens (Reynolds et al. 1996) and any salvageable individuals encountered in traps or as roadkills. Where possible, individuals found dead will be prepared as voucher specimens. Otherwise, voucher specimens of small mammals (shrews, voles, mice and rats) will be obtained from individuals captured live and euthanized by cervical dislocation or thoracic compression (ASM 1998) or selective kill trapping using Museum Special snap traps (Woodstream Corporation, Lititz, Pennsylvania). Specimens of only those species for which no record exists for the park will be sought. Moles, medium- and large-sized mammals will be documented as photo vouchers; photo vouchers or specimen vouchers from trap mortalities, roadkills or individuals found dead; or collection of sign. Threatened and endangered species will not be sacrificed for voucher specimens; photo documentation will be made where possible and/or hair samples will be collected. Specimens deposited at FSU will be catalogued in the University's database.

### *Reports*

Progress reports will be submitted annually. A draft of the final report will be submitted digitally to the Northeast Region, I & M Program. The final report will be submitted digitally and in hard copy. Any graduate student theses incorporating the work done to comply with the requirements of this agreement will be submitted in hard copy.

### *Bibliographic citations*

A reprint will be provided for each publication or thesis based on work completed under this agreement.

## **Project Timetable**

| <u>Dates</u>               | <u>Activities</u>  |
|----------------------------|--|
| 31 August 2001             | Submit proposal  |
| January-May 2002           | Obtain historical records of mammals for GEWA and THST, outline and ground-truth strata and establish sampling sites, establish sampling protocol, design database (template)                  |
| March-November 2002        | Conduct survey of mammals at GEWA and THST, refine sampling protocol, establish procedures for data analyses   |
| August – December 2002     | Obtain historical records of mammals of COLO, outline and ground-truth strata and establish sampling sites, establish sampling protocol, design database (template), conduct survey of mammals |
| November 2002-January 2003 | Prepare progress report  |
| March-November 2003        | Complete survey of mammals at GEWA and THST, compile data; conduct survey of mammals at COLO, refine sampling protocol, establish procedures for data analyses                                 |
| November 2003-January 2004 | Analyze data, prepare progress report  |
| March – November 2004      | Complete survey of mammals at COLO, compile and analyze data   |
| November 2004-January 2005 | Analyze data, prepare final report (with species data, GPS data, metadata)   |

## Literature Cited

- ASM. 1998. Guidelines for the capture, handling, and care of mammals as approved by the American Society of Mammalogists. *Journal of Mammalogy* 79:1416-1431.
- Barry, R. E., K. A. Boyce, and A. C. Sucke. 1999. Local distribution, habitat, and home range of the Appalachian cottontail (*Sylvilagus obscurus*) at Dolly Sods. Final report submitted to the Nongame Wildlife and Natural Heritage Program, West Virginia Division of Natural Resources.
- Boyce, K. A. 2001. Distribution, seasonal home range, movements and habitat of the Appalachian cottontail, *Sylvilagus obscurus*, at Dolly Sods, West Virginia. M. S. thesis, Frostburg State University, Frostburg, Maryland.
- Cummings, J. R., and S. H. Vessey. 1994. Agricultural influences on movement patterns of white-footed mice (*Peromyscus leucopus*). *American Midland Naturalist* 132:209-218.
- Gage, K. L., R. S. Ostfeld, and J. G. Olson. 1995. Nonviral vector-borne zoonoses associated with mammals in the United States. *Journal of Mammalogy* 76:695-715.
- Jones, C., W. J. McShea, M. J. Conroy, and T. H. Kunz. 1996. Capturing mammals. Pp. 115-122 in *Measuring and monitoring biological diversity: standard methods for mammals* (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- Jones, C., R. S. Hoffmann, D. W. Rice, M. D. Engstrom, R. D. Bradley, D. J. Schmidly, C. A. Jones, and R. J. Baker. 1997. Revised checklist of North American mammals north of Mexico, 1997. Occasional papers, Museum of Texas Tech University 173:1-20.
- Kirkland, G. L., Jr., and P. K. Sheppard. 1994. Proposed standard protocol for sampling of small mammal communities. Pp. 277-283 in *Advances in the biology of shrews* (J. F. Merritt, G. L. Kirkland, Jr., and R. K. Rose, eds.). Special Publication of the Carnegie Museum of Natural History 18, Pittsburgh, Pennsylvania.
- Krebs, C. J. 1999. *Ecological methodology*. Second edition. Addison Wesley Longman, Inc., Menlo Park, California, 620 pp.
- Kunz, T. H., R. Rudran, and G. Gurri-Glass. 1996. Appendix 2: Human health concerns. Pp. 255-264 in *Measuring and monitoring biological diversity: standard methods for mammals* (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- McDiarmid, R. W., and D. E. Wilson. 1996. Data standards. Pp. 56-60 in *Measuring and monitoring biological diversity: standard methods for mammals* (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- Mills, J. N., T. L. Yates, J. E. Childs, R. R. Parmenter, T. G. Ksiazek, P. E. Rollin, and C. J. Peters. 1995. Guidelines for working with rodents potentially infected with hantavirus. *Journal of Mammalogy* 76:716-722.

- NPFauna. 2001. Species in parks: flora and fauna database. <http://ice.ucdavis.edu/nps/>.
- NPS. 1998. Natural resource inventory & monitoring in national parks. NPS Inventory and Monitoring Informational Brochure. <http://www.nature.nps.gov/im/imbrosch.htm>.
- NPS. 2000. Guidance for the design of sampling schemes for inventory and monitoring of biological resources in national parks. National Park Service Inventory and Monitoring Program.
- Reynolds, R. P., R. I. Crombie, R. W. McDiarmid, and T. L. Yates. 1996. Voucher specimens. Pp. 63-68 in Measuring and monitoring biological diversity: standard methods for mammals (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- Rudran, R. 1996. General marking techniques. Pp. 299-304 in Measuring and monitoring biological diversity: standard methods for mammals (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- Rudran, R., and M. S. Foster. 1996. Conducting a survey to assess mammalian diversity. Pp. 71-79 in Measuring and monitoring biological diversity: standard methods for mammals (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- Rudran, R., and T. H. Kunz. 1996. Appendix 1: Ethics in research. Pp. 251-254 in Measuring and monitoring biological diversity: standard methods for mammals (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, eds.). Smithsonian Institution Press, Washington, District of Columbia.
- Wilson, D. E., and D. M. Reeder (eds.). 1993. Mammal species of the world: a taxonomic and geographic reference. Smithsonian Institution Press, Washington, District of Columbia.
- Zar, J.H. 1999. Biostatistical analysis. Fourth ed. Prentice Hall, Upper Saddle River, New Jersey.

**Budget**

|  | <u>Agency<br/>Request</u> | <u>FSU<br/>Match</u> |
|--|---------------------------|----------------------|
| <b>I. Personnel assignments and costs</b>  |                           |                      |
| A. Dr. Ron Barry's release time/summer stipend - \$7,900/mo./yr.   | <b>\$15,800</b>           | <b>\$15,800</b>      |
| B. GEWA and THST: 2-semester research assistantship (\$5,000) +<br>1-summer assistantship (\$2,000) + January stipend (2 <sup>nd</sup> yr. @ \$1000)<br>for 1 graduate student | <b>8,000</b>              | <b>7,000</b>         |
| C. COLO: 2-semester research assistantship (@\$5,000) + 1-summer<br>assistantship (@\$2,000) + January stipend (2 <sup>nd</sup> yr. @ \$1,000) for 2<br>graduate students      | <b>16,000</b>             | <b>14,000</b>        |
| D. Tuition waiver for 3 graduate students @ \$3,600/yr./student for 2 yrs. each  |                           | <b>21,600</b>        |
| E. Rabies vaccine – (3 series @ \$240) + (1 booster @ \$80)  | <b>800</b>                |                      |
| F. Student health insurance (Sentry Student Security Plan – E. J. Smith &<br>Associates) for 3 graduate students @\$300/yr./student for 3 students for<br>2 yrs. each          | <b>1,800</b>              |                      |
| <b>I. Total</b>  | <b>\$42,400</b>           | <b>\$58,400</b>      |

**II. Transportation\***

|  |                 |                |
|--|-----------------|----------------|
| A. Roundtrip to GEWA and THST – (30 trips @ 505 mi/trip) +<br>(55 mi/trip local travel X 4/trip X 30 trips) = 21,750 mi @ \$0.32/mi<br>(FSU institutional rate) + (120 bridge tolls @ \$1.50/toll) | <b>\$7,140</b>  |                |
| B. Roundtrip to COLO – (40 trips @ 504 mi/trip) +<br>(22 mi/trip local travel X 4/trip X 40 trips) = 23,680 mi @ \$0.32/mi   | <b>7,578</b>    |                |
| C. Dr. Ron Barry's travel – 12,000 mi @ \$0.32/mi  |                 | <b>\$3,840</b> |
| <b>II. Total</b>   | <b>\$14,718</b> | <b>\$3,840</b> |

**III. Lodging\*\***

Supplied by NPS. If not, lodging expenses are needed for 90 nights  
for GEWA/THST and 240 nights for COLO.

**IV. Equipment, supplies, services, etc.**

|   |                |
|---|----------------|
| A. Sherman live traps – 300 @ \$14.00 (-5%) + \$100 shipping                | <b>\$4,090</b> |
| B. Tomahawk single-door, collapsible (squirrel size) – 30 @ \$30.00         | <b>900</b>     |
| C. Tomahawk single-door, collapsible (raccoon/feral cat size) – 6 @ \$70.00 | <b>420</b>     |
| D. Tomahawk single-door, collapsible (bobcat size) – 2 @ \$170.00           | <b>340</b>     |
| E. TrailMaster TM 1500 Active IR trail monitor – 2 @ \$260                  | <b>520</b>     |

|   |                 |                 |
|---|-----------------|-----------------|
| F. TrailMaster TM 35-1 Camera Kit – 2 @ \$290   | 580             |                 |
| G. TrailMaster TM Data Collector – 2 @ \$250  | 500             |                 |
| H. SONY MVC-CD 1000 CD Mavica digital camera  | 1,000           |                 |
| I. Dell Inspiron 2100 notebook computer with 20 GB hard drive, 256 MB RA,<br>and extra battery  | 2,150           |                 |
| J. 3 Nokia 5185i cell phones @ \$100  | 300             |                 |
| K. Pesola scales (3 ea. 30-g and 100-g, 2 ea. 10-g and 600-g)   | 340             |                 |
| L. 5 silt fences (for pitfall arrays); 2' X 100' @ \$18.00  | 100             |                 |
| M. Miscellaneous supplies (flagging, bait, stakes, sampling bags, trap bedding,<br>specimen preparation supplies, map acquisition, ear tags, dye, computer<br>supplies, field gear, photocopying, etc.), shipping expenses for traps and<br>other equipment and supplies, etc.  | 1,000           |                 |
| N. Equipment, supplies, and additional support (traps, densiometers,<br>compasses, measuring tapes, ear tags, Pesola scales, binoculars, night-vision<br>binoculars, aerial photo stereoscope, specimen storage and maintenance,<br>graduate faculty support, secretarial and technician support, photocopying<br>and duplicating services, mail, etc.) |                 | \$5,000         |
| O. Computer services (data compilation and statistical analysis, report<br>preparation, e-mail, etc.)   |                 | 6,000           |
| P. Attendance, paper presentation at professional meetings @ \$1,000/yr. for<br>2 yrs.  | 2,000           |                 |
| <b>IV. Total</b>  | <b>\$14,240</b> | <b>\$11,000</b> |
| <b>Project Subtotal</b>   | <b>\$71,358</b> |                 |
| <b>Indirect costs (15% according to CESU arrangement)</b>   | <b>\$10,704</b> |                 |
| <b>PROJECT TOTAL</b>  | <b>\$82,062</b> | <b>\$71,240</b> |

\* These costs might be reduced by additional FSU matching support

\*\* If park lodging is not available, additional support is sought for local lodging for investigators

## **Budget Justification**

| <u>Item #</u> | <u>Justification</u>   |
|---------------|--|
| I. A          | Support for the project director (cooperator) for either course release and/or summer salary for 2 years for project coordination, field work, data analysis, report preparation, etc.   |
| I. B, C, D    | Three graduate students are needed to conduct the proposed work within the proposed period. Support in the amount of a stipend for 1 academic year, summer, and January each is requested for each of 3 students. FSU will provide a 2nd year (including summer) of stipend and 2 years (36 credits) of tuition waiver for each of these students. |
| I. D          | Graduate tuition and fees @ \$200/credit X 36 credits/ student X 3 students  |
| I. E          | For 3 graduate students and project director (booster only)  |
| I. F          | Basic coverage (maximum \$3,000 benefits/yr.) for graduate students  |
| II. A, B      | Reimbursement for use of vehicles by investigators to travel to, from, and within study sites  |
| II. C         | Based on estimated availability of FSU vehicle   |
| III.          | If NPS lodging is not available, NPS support for such will be sought.  |
| IV. A, B      | Traps needed for simultaneous trapping at 3 national parks   |
| IV. C, D      | Traps needed for simultaneous trapping of medium-sized mammals at 3 national park  |
| IV. E, F, G   | Remote detection units and cameras needed for documentation of larger, secretive and elusive mammals   |
| IV. H         | Camera needed for voucher specimens, confirmation of identifications of amphibians and reptiles in pitfall traps, etc.   |
| IV. I         | Computer needed for compilation, manipulation, storage, integration, and analysis of species data, GPS data, metadata, and field data  |
| IV. J         | Needed for safety and convenience of 3 graduate students who will be in the field simultaneously   |
| IV. K         | Additional scales needed for simultaneous trapping at 3 national parks   |
| IV. L         | Fencing needed to establish pitfall trap arrays (for capturing shrews and other small mammals < 10 g) at 3 national parks  |
| IV. M         | Self-explanatory   |
| IV. N         | Support from FSU's Department of Biology   |



- IV. O Support from FSU's Computing Services, Academic Computing, and departments of Biology and Mathematics
- IV. P Travel, registration, lodging, and meals for 3 graduate students and project director for 2 yrs.

## ***9.2 Herpetological Inventory (COLO, GEWA, THST)***

Inventory of Amphibians and Reptiles of Colonial National Park, George Washington Birthplace National Monument, and Thomas Stone National Park

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### **Abstract**

This proposal is submitted for support of an inventory of amphibian and reptile species on three national parks: Colonial National Historic Park, George Washington's Birthplace National Monument, and Thomas Stone National Historic Site. Existing information on these vertebrates in these three parks varies from incomplete to non-existent. Field work will include several types of standardized inventory techniques, such as frog call surveys, larval amphibian surveys with dipnets and minnow traps, snake surveys with minnow traps, road driving at night, and surveys of turtles with baited hoop traps. A voucher photograph collection will be provided. Field work would begin in late summer or early fall 2001 and continue through October 2002. A final report will include electronic files of site-specific species observations for each park.

### **Statement of Issue**

The information on the species of amphibians and reptiles occurring in Colonial National Historic Park (COLO), George Washington's Birthplace National Monument (GEWA), and Thomas Stone National Historic Site (THST) varies from being moderately well known to nearly completely unknown. This inventory will fill numerous gaps in the baseline of information on the occurrence of these vertebrates in habitats within these three parks.

Although amphibians and reptiles occupy many different kinds of habitats (e.g., vernal pool wetlands, hardwood forests) and move extensively between wetlands and uplands, it is possible to associate species with general habitat types. Such information is critical to the development of management recommendations that will benefit these habitats, the herps populations, and other species. Therefore, an inventory of amphibians and reptiles in any area should be couched within a framework of selected habitats. If locality information is included in such inventories by either GPS coordinates or collection/observation sites plotted on detailed maps, then resource managers will have a valuable database they can use for a variety of habitat-specific or site-specific management needs.

### **Literature Review**

Eckerlin (1991) published a short summary of observations and a list of herp species observed during a mammal study conducted in the mid-1980s on GEWA, noting 12 amphibians and 18 reptiles. He noted that the list was likely incomplete and expected several species to be added with more fieldwork. The amphibians and reptiles of COLO are less well known. There is no comprehensive list but several species have been noted in reports that focused on other aspects of the natural history of the area, notably by the VA Division of Natural Heritage (e.g., Van Alstine et al., 2001). At least one state-threatened species occurs in COLO, Mabee's salamander (*Ambystoma mabeei*) (Dana Bradshaw, Center for Conservation Biology, College of William and Mary, personal communication). The current study by me on Jamestown Island is contributing a substantial list of species for this portion of the park (11 amphibians and 13 reptiles as of May 2) but the other 6900 acres still need a thorough inventory. There is no information on the amphibians and reptiles of THST in southern Maryland. Thus, an accurate list of amphibians and reptiles is needed for each of these parks.

## Objectives

I propose to conduct a habitat-based inventory of the amphibian and reptile fauna on COLO, GEWA, and THST that meet the following objectives: (1) obtain as complete as possible within funding and time constraints a list of the species of amphibians and reptiles that occur in each park, including any listed species, (2) associate each species with NPS-specified habitat types, (3) provide GPS coordinates for species occurrences with the final report, and (4) when the data allow from standardized protocols, provide quantitative estimates of relative abundance of selected species.

## Study Area

Three parks will be included in this project - Colonial National Historic Park, George Washington's Birthplace National Monument, and Thomas Stone National Historic Site. All habitats that may support amphibians and reptiles will be searched. The study area will consist of the entire park, particularly areas that are readily accessible to my field crew and me. We will avoid any situation that may interfere with public activities in the parks.

## Methods

### Field Methods

Most amphibians and reptiles are secretive animals that require two kinds of efforts to encounter and study them - (1) being in the field when they are active and (2) using standardized trapping and survey techniques to aid in their capture for study. These are very seasonal animals that respond to changes in climate, temperature, and precipitation. Enough time in the field in the activity seasons for target species ensures that researchers will encounter most of these animals. Some species are active and breed in late winter and are not seen or heard for another year. Some are active and breed in the late spring and summer. At least one amphibian species is active primarily in the fall. Field work must take place when these animals are active in places where we have access to them. Standardized techniques provide quantitative baseline data on relative

abundances and help to increase the probability that we will encounter most of the species present in the study area. Such baseline data allow future researchers and managers to evaluate changes in the fauna and in species' populations. Thus, time (lots of it) and standardized techniques combined provide the most useful information.

The following standardized techniques will be used throughout the appropriate field seasons in this study: visual encounter surveys (time-constrained), frog call surveys at night, larval amphibian surveys with dipnets and minnow traps, snake surveys with minnow traps, road driving at night, and turtle traps. The techniques used for amphibians are described fully in Heyer et al. (1994) and Mitchell (2000). The techniques for reptiles are described in Jones (1986), Mitchell (1994), and Blomberg and Shine (1996).

The survey work will commence within a month of contract approval by NPS and the University of Richmond (and when the budget account is established at the university). Actual starting and execution dates will depend on weather, as rain events strongly correlate with and influence herp activity. Work would be done in day-long field trips when trapping is not used. When traps are employed, trips will be 2 days in duration, with traps set one day and pulled the next. All captured animals will be handled in accordance with VA Department of Game and Inland Fisheries guidelines (these are actually national guidelines) and no animal should be harmed in the process. Once positive identifications are made and photos taken as needed, the animal will be released at the site of capture. Coordinates of all sites of capture will be determined by a combination of GPS units and digital topographic map evaluation.

#### Office/lab Methods

All data will be recorded on standardized field data sheets and subsequently entered into an electronic database (Excel or Access). Photographs will be taken of all species and their habitats to the extent possible and assembled in digital form. The final report will include the database and illustrations, along with the results, summary of the survey, and management recommendations.

#### Quality Assurance/Quality Control

QA/QC procedures affect two aspects of this project, execution of the protocols and accurate data collection. Quality and accurate execution of the protocols will be ensured by training sessions for all personnel, especially the field team leader. The primary field technician has worked for me for years and knows how to execute these protocols and take the required data accurately. Accurate data collection is first and foremost to correctly identify the animal one has seen or has caught. This is done primarily by experienced personnel and not by assistants that have not demonstrated excellence in herp species identification. The other aspect of data accuracy is taking environmental and individual information in consistent ways. This aspect, again, will be reviewed in training sessions.

The data sheets obtained from a field trip will be reviewed by the principal investigator after each trip. This will help to insure that any questions about the information have been answered before the data are entered into an electronic database. Data entry will be done by the principal investigator and, possibly, by the primary field technician.

## Specimen Collections

Individual amphibians and reptiles will not be sacrificed for museum collections unless absolutely necessary. Photographs will serve as the vouchers for each species in each park. The only specimens to be collected are selected amphibian larvae that need to be identified (best done with a microscope in some cases, especially for small larvae). Malformed or diseased amphibians will be collected in accordance with the guidelines from the National Wildlife Health Center in Madison, Wisconsin. Such specimens will be evaluated by these professionals and will not result in voucher material as the entire carcass is destroyed in the necropsy process.

I would like for park personnel to collect and freeze road-killed reptiles, especially snakes, for later identification. Snakes are especially difficult to inventory because they are so secretive. Such salvaged road-kills provide a very valuable contribution to a herp inventory. The disposal of the salvaged specimens will be determined with the input from the respective park resource manager.

## Schedule

The field portion of the project should commence no later than mid-August 2001 and carry through at least October 2002. The draft final report will be provided by 31 December 2002. Field research personnel will coordinate with park personnel and meet all NPS requirements to the extent possible. We will learn how to work with park dispatch people to ensure that they know where we will be working each day we are on site.

## Deliverables

Monthly summaries of the work conducted will be provided to the Natural Resources staff contact person, usually by email message. I will provide information immediately on state or federally listed species observed or caught in the study area, as is required by the state collection permit.

Products include draft and final reports with attachments (e.g., computerized database in the format for the NPS database [compatible with NPSpecies], NPS-specified software, e.g., Adobe). These reports will include text, tables, figures, and photographs and follow NPS I&M guidelines. An article will be prepared for each park to be included in Park Science. A presentation will be made to each of the park's staff on the project and its results at the end of the project.

Journal publications include a summary/review of the inventory results and natural history of the amphibians and reptiles for each park. Target journals include Maryland Naturalist, Virginia Journal of Science, and Banisteria. Substantial and new natural history observations may be submitted to the national journal Herpetological Review or an appropriate regional journal (e.g., Northeastern Naturalist).

## Special Requirements and Concerns

## Services provided by NPS

The following services are needed from NPS so that this project can be completed in a timely manner.

1. Scientific collection permits for each park.
2. Detailed maps of the park and maps indicating sensitive areas for each park.
3. A list of primary habitat types and a map showing their location and distribution in the park.
4. Technical support for (a) establishment of Access (or other) database for field data entry, (b) support for report production, (c) software needed to meet data entry and report requirements, and (d) technical support for GPS coordinates (this may include borrowing a GPS unit).
5. Collection of road-killed reptiles and amphibians by park personnel. These specimens must be labeled by location and date (on a 3x5 card inserted into the plastic bag) and stored in a freezer.

## Literature Cited

- Blomberg, S., and R. Shine. 1996. Reptiles. Pp. 218-226 In W.J. Sutherland (ed.), *Ecological Census Techniques, a Handbook*. Cambridge University Press, Cambridge, UK.
- Eckerlin, R.P. 1991. The herpetofaunal of George Washington Birthplace National Monument, Virginia. *Catesbeiana* 11:11-17.
- Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster. 1994. *Measuring and Monitoring Biological Diversity, Standard Methods for Amphibians*. Smithsonian Institution Press, Washington, DC. 364 pp.
- Jones, K.B. 1986. Amphibians and reptiles. Pp. 267-290 In A.Y. Cooperrider, R.J. Boyd, and H.R. Stuart (eds.), *Inventory and Monitoring of Wildlife Habitat*. US Dept. of Interior, Bureau of Land Management Service Center, Denver, CO.
- Mitchell, J.C. 1994. *The Reptiles of Virginia*. Smithsonian Institution Press, Washington, DC. 352 pp.
- Mitchell, J.C. 2000. *Amphibian Monitoring Methods & Field Guide*. Smithsonian National Zoological Park, Conservation Research Center, Front Royal, VA. 56 pp.
- Van Alstine, N.E., A.C. Chazal, and K.M. McCoy. 2001. A biological survey of the coastal plain depression ponds (sinkholes) of Colonial National Historical Park, Yorktown, Virginia. *Natural Heritage Technical Report 01-9*, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 48 pp. + appendices.

## Peer Review

The following people could be contacted for review of this proposal.

Dr. Carola Haas, Associate Professor, Department of Wildlife and Fisheries Science, VPI and SU, Blacksburg, VA 24019. 540-231-9269 office phone.

Dr. Robin E. Jung, Northeast Coordinator of ARMI, USGS Patuxent Wildlife Research Center, 12110 Beech Forest Rd., Laurel, MD 20708. 301-497-5675 office phone.

Dr. Thomas K. Pauley, Professor, Department of Biology, Marshall University, Huntington, WV 25755. 304-696-2376 office phone.

## Budget (US\$)

|                      | COLO  | GEWA  | THST  | Combined |
|----------------------|-------|-------|-------|----------|
| Personnel            | 10065 | 3617  | 3617  | 17299    |
| JCM                  | 11000 | 4500  | 4500  | 20000    |
| Fringe (JCM)         | 935   | 383   | 383   | 1701     |
| Travel               | 2000  | 1000  | 1000  | 4000     |
| Supplies             | 1000  | 500   | 500   | 2000     |
| Subtotal             | 25000 | 10000 | 10000 | 45000    |
| Indirect costs (10%) | 2500  | 1000  | 1000  | 4500     |
| Total                | 27500 | 11000 | 11000 | 49500    |

## Personnel and Qualifications

The principal investigator, Dr. Joseph C. Mitchell, has a long history of conducting inventories on amphibians and reptiles in many areas, ecosystems, and habitats. He is a Research Biologist at the University of Richmond. He has published over 200 papers on the ecology and natural history of these vertebrates, as well as three books. His resume is attached.

The primary field technician is likely to be C. Todd Georgel. Todd is completing his Master's Degree at Christopher Newport University this year. He has worked for Dr. Mitchell for five years on several projects dealing with inventory of amphibians and reptiles on public lands. These include Fort A.P. Hill, three military bases in North Carolina, Shenandoah National Park, and Jamestown Island (part of COLO). He is very experienced in species identification, field techniques, and data collection. Todd will serve as field team leader for those field trips on which I cannot attend. There will likely be one assistant and one or more students who will help with various aspects of this project. These people have yet to be identified.

## Section X Literature Cited

- British Columbia Ministry of Environment, Lands and Parks, Resources Inventory Branch. 1998. Species Inventory Fundamentals. Standard for Components of British Columbia's Biodiversity No. 1.
- Cook, R. P. and Zuzworsky, J. 2000. Herpetofaunal Community Restoration at Gateway NRA. Abs. Proc. of Conference "Resource Stewardship: Meeting the Challenges in 2000 and Beyond". Valley Forge PA. George Wright Society.
- Cook, R.P. 1982. Representative animal community being recreated at Jamaica Bay. Park Science 2(4):3-4. (USDI, National Park Service)
- Cook, R.P. 1989. And the voice of the grey tree frog was heard again ... (herpetofaunal restoration at Gateway NRA). Park Science. 9 (3):6-7. (USDI, National Park Service)
- Cook, R.P. 1996. Movement and ecology of eastern box and painted turtles repatriated to human-created habitat. Ph.D. Diss., City University of New York. xii +276 pp.
- Cook, R.P. and Tanacredi, J.T. 1990. Management strategies for increasing habitat and species diversity in an urban national park. in Berger, J.J. (ed.), Environmental restoration: science and strategies for restoring the Earth. Island Press, Washington, DC.
- Cook, R.P., and J.L. Behler, W. Holmstrom, C. Castellano, and B. Lane. 1999. Restoration of Fowler's toad (Bufo woodhousei fowleri) and eastern hognose snake (Heterodon p. platirhinos) at the Sandy Hook Unit of Gateway NRA. (Presentation Abstract). 10<sup>th</sup> Conference on Research and Resource Management in Parks and on Public Lands. Ashville, NC.
- Cook, R.P., and Pinnock, C.A. 1987. Recreating a herpetofaunal community at Gateway National Recreation Area. pp. 151-154, In L.W. Adams and D.L. Leedy (eds.) Integrating man and nature in the urban environment. National Institute for Urban Wildlife, Columbia, MD.
- Denali National Park data management protocol (1999) and the I&M Program Data Management Protocol (1997)
- Dutton, Bryan E., Sagamore Hill National Historic Site, Vascular Plant Survey, Nov. 1997.
- Fancy, S.G. and J.R. Sauer. 2000. Recommended methods for inventorying and monitoring landbirds in national parks. Unpublish. Report.
- Fancy, Steven G. 2000. Guidance for the design of sampling schemes for inventory and monitoring of biological resources in National Parks. The National Park Service Inventory and Monitoring Homepage, [www.nature.nps.gov/sfancy](http://www.nature.nps.gov/sfancy).
- Feinberg, J. A. and Burke, R.L. (draft ms). Nesting ecology of diamondback terrapin, Malaclemys terrapin, at Gateway National Recreation Area, New York, USA. Fishes.
- Kiviat, Erik. Sagamore Hill National Historic Site Habitat Assessment. Report to The Nature Conservancy. April 18, 1997.
- Krebs, C. J. 1999. Ecological methodology. Second edition. Addison Wesley Longman, Inc., Menlo Park, California, 620
- Stalter, Richard. Annotated checklist of the vascular plants of Sagamore Hill National Historic Site, New York. Bartonian No. 97-104, 2000.